EDITORIAL

SHORTLY after a number of its members signed a petition asking Senator Reed to resign, the Missouri legislature passed a bill authorizing a pension of $15 per month to all blind persons.

"DEBS out of jail, or all of us in jail" was the resolution adopted at a meeting recently held at Cleveland. Well, if they have the nerve to persevere, most of them will get their wish.

IN opposing the absurd 'No beer, no work' movement, Mr. Henry F. Hilfers, secretary of the New Jersey State Federation of Labor, made one statement that is of general application, namely, "A general strike always means disruption of organized labor." Enough said.

ONE hundred years ago, on June 20, the 'Savannah' completed the first transatlantic trip ever made by a steam-vessel, making the trip from Savannah to Liverpool in 29 days. It is more than likely that, before the centenary is actually celebrated, another form of locomotion, namely, the aeroplane, will be used for the same trip.

THE large proportion of eye injuries in most shops and the consequent importance of the use of goggles is not generally appreciated. In one large plant in the Bay district, special pains are taken, both by education and by discipline to have the employees wear goggles on all occasions when there is danger of eye injuries. Nevertheless, during a typical month, of 34 injuries requiring any medical attention whatever, 18 were eye-injuries, all of which could probably have been prevented had the company's instructions regarding goggles been observed strictly.

CONSIDERABLE disappointment has been expressed over the relatively poor showing made by Mr. Hohenzollern, formerly Kaiser Bill, in the wood business. It seems that, although he has been working at it pretty steadily three hours per day since leaving Germany a few hours ahead of the sheriff, he has earned, at the prevailing rate of wages, only 50 cents per day. However, it should be remembered that this is the first useful work he has ever done in his life, and we should not expect too much. Perhaps, provided he is not hanged in the meantime, in ten years he may be able to qualify for regular union wages.

OUR attention has been called to the fact that Mr. Roy S. Bonsib, safety engineer for the Southern Pacific District, Emergency Fleet Corporation, was misquoted on page 148 of our March issue regarding the Pacific Coast Shipbuilding Co. yard at Bay Point. What Mr. Bonsib really said was that the yard, in the application of safety principles, rules, and devices, was the equal of any yard in the Southern Pacific District.

IN response to protests from commercial bodies all along the Pacific Coast, the United States Railroad Administration has announced a slight reduction in transcontinental freight-rates on most commodities for export. The new rates are still higher than the prewar transcontinental export rates, and the reduction is insufficient to compensate for the small difference in ocean freight-rates to the Orient from Atlantic ports and from Pacific ports. However, they do enlarge considerably the territory in the Mississippi valley where Pacific ports have an equal chance with Atlantic ones. Furthermore, they are a step in the right direction, and indicate that the Railroad Administration realizes the need for distributing the Nation's foreign commerce instead of concentrating it at New York and a few other Atlantic ports.

SANITATION and medical and surgical care have made military service safer than in previous wars, in spite of the increased effectiveness of weapons. During the Mexican war the death rate from disease was 110 per 1000 and in battle 15, making a total of 125. In the Civil war, the corresponding figures were 65, 33, and 98. In the present war they were 17, 57, and 74. Contrary to the general belief the disease rate during the Spanish war was much lower than in the Civil war.

AMONG the items lost in the tremendous shuffle executed by Congress during the last few days of the session was the appropriation for the United States Employment Service. As a result, only a skeleton organization will be maintained until further appropriations are made, although the particular work of finding jobs for returned soldiers will be carried on by other organizations. While it is true that failure to get an appropriation from the last Congress is not necessarily a sign of lack of merit, we cannot help feeling that the money might have been voted had not certain objectionable activities of the Service brought discredit on all its work, which undoubtedly included much that was meritorious and useful. Furthermore, we believe that the Service stands a much better chance of obtaining the necessary funds from the next Congress if it expresses itself as ready to quit dictagraph investigations and 'organizing' of non-union plants and confine itself to the legitimate activities of an employment bureau.

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The Victory Loan

During the coming month, the drive for the Victory Loan will take place. There are several factors that will make it hard sledding for the solicitors. Business men and wage-earners are not making as much money as they did before the armistice; large income taxes have just been paid and further installments to come, and there is a general tendency since the armistice to stand pat and 'let George do it.' 'George' in this particular case is the long-suffering banks. In spite of all these adverse conditions, the Loan will be over-subscribed, like all its predecessors, for the reason that when the American people start something, they finish it. A great deal of money has been spent since the armistice for the reason that it was impossible to stop our war machine dead in its tracks. Some money, both before and after the armistice, was wasted; there is no use crying over spilt milk now. The money is spent and the end we helped to accomplish, the downfall of Prussianism, was worth all and more than we paid for it. Therefore, let us not be pikers, but put the Loan over the top with a hurrah that will be heard around the world.

Congress Adjourns

Many of us who followed the debates of the last few days of the now-expired Congress are reminded of the little boy who remarked that the chaplain "looked at Congress, and then prayed for the country." After being in almost continuous session for the past two years, the Sixty-Fifth Congress has adjourned leaving behind probably the largest quantity of unfinished business that ever a congress passed to its successor. Among the more important measures to be crowded out at the last moment were the army and navy bills, the railroad appropriation bill, the mineral-land leasing bill, the water-power bill, and Secretary Lane's reclamation bill to provide farms for returned soldiers and sailors. Add to that the fact that Congress completely side-stepped the preparation of any plan for a permanent solution of the railroad question, and we have a long record of non-achievement. Is it any wonder that the prestige of the legislative branch of the Government has suffered during the past few years?

Road-Racing and Business

Keen observers of automobile road-races have noticed that picking the winner can best be done by studying the methods of each driver as he rounds the curves. Given cars of equal power, comparatively little advantage can be obtained on the straightaways. But, on the curves, the skilful driver, after reducing his speed slightly, re-opens his throttle before he has quite reached the straight road again, so that he may be able to attain the maximum speed as soon as safety permits. The driver that is not quite so far-seeing fails to open his throttle wide until he has actually reached the straight road, and, by the time his car is back at maximum speed, he is several yards behind. Just at present business is rounding a rather sharp corner, but the big rewards will come to the man that has the nerve to open wide his throttle now rather than wait until readjustment has been completed.

German in the Schools

By a vote of 29 to 7, the California Senate has passed a bill to prohibit the teaching of German in any school in California, public or private, and thus protect the youth of the State from the pernicious teachings of Goethe, Schiller, Heine, and other prominent representatives of the Prussian Junker class. Apparently the vigilant twenty-nine are so ignorant as to be unaware that certain lines of technical and other research would be impossible without a knowledge of German. There are even certain scientific calculations that cannot be made without the use of tables found only in German books. In some States the teaching of German, and in fact the conducting of other classes in German in the elementary schools, used to be a great evil. It never became really objectionable in California, and has been eliminated everywhere since the War. German has not been popular in the high schools recently and probably will not be for some time to come. Some of the smaller schools have therefore discontinued their German classes. As far as the colleges and universities are concerned, the study of German, like the study of every important foreign language, should be encouraged if we are to take our rightful place in the world's trade. The bill should and probably will be killed.

Financing Foreign Trade

It is not generally known that the Victory Loan bill, which was among the few that ran the gauntlet of those last days of the Congressional session, contains some important and radical provisions for Government financing of foreign trade. These authorize the Federal government to advance to exporters an amount not exceeding $1,000,000,000 for a period not exceeding five years to enable them to finance foreign sales when unable to do so through ordinary business channels. This plan is a frank recognition of the fact that, if this country is to maintain its export business, it will have to give credits as well as goods. European countries in particular are not able to finance their purchases to the same extent as before the War. Since the Federal government is better able to protect its advances than any private corporation, it becomes the logical agency for making these advances. Another section of the bill authorizes the Government to extend the necessary credits to other governments to cover the large amount of property that it now holds abroad and which other govern-

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ments wish to buy. It is significant that the entire scheme, which a few years ago would have been denounced on all sides as dangerously socialistic, now evokes but little comment, and that wholly favorable.

Training for all American Soldiers

The Federal appropriation for vocational education of disabled soldiers is necessarily limited to those whose injuries were received when serving under the American flag, and cannot be used for the benefit of Americans who could not wait for this country to enter the War, but enlisted and suffered under other flags. There are also a few other technicalities, necessary where Government funds are concerned, but which, nevertheless, might militate against extending assistance to some man who was worthy of it. Because of these conditions, the Order of Elks has placed $150,000 at the disposal of the Federal Board for Vocational Education for use without restrictions. This is a splendid gift and one that will salvage the lives of hundreds of men that might otherwise be without a future. At the time of making this announcement, the Board also gave out some interesting statistics of its work to date. In all, 7710 disabled men have been certified for vocational re-education. Contrary to the general expectation, tuberculosis and other lung complaints caused more disablement than any other one cause, the total number of cases being 2791, or 36% of the total. The number of 'major amputation', on the other hand, was only 3034, and quite a number of these were engaged in such work before enlistment that they can return to it without re-training.

Price Stabilization and Business

Progress toward price-stabilization has been made by the newly-created Industrial Board of the Department of Commerce, which is composed of Messrs. George N. Peek, chairman, Samuel P. Bush, Anthony Caminetti, Thomas K. Glenn, George R. James, T. C. Powell, and William M. Ritter. Messrs. Peek, Bush, and Glenn are in the steel business, either as producers or manufacturers. Mr. James is president of a drygoods company and Mr. Ritter of a lumber company. Mr. Powell is director of capital expenditures for the Railroad Administration, and Mr. Caminetti is commissioner of immigration. At the time the Board was appointed, any attempt at price-fixing was expressly disclaimed. Producers and consumers of staple materials are to be consulted and a schedule of fair prices is to be prepared and announced for each industry affected. The Government departments, when calling for bids, will call attention to these schedules and to the fact that they will consider offers to supply the Government at approximately these prices. It is expected that this will tend to stabilize prices at these levels, since prospective buyers will no longer delay purchases. At the first meeting of the Board, prices were 'suggested' for the iron and steel industry. These are given in detail in another column. In general, they provide for a reduction of $4.25 per ton on pig-iron, $5 per ton on billets, and $7 per ton on structural shapes, plates, and bars. No reduction is made on iron ore, nor is one contemplated unless freight-rates are reduced, a rather improbable contingency in view of the steadily mounting railroad deficits. At the same time, Mr. E. H. Gary stated, on behalf of the steel industry, that prices would probably not be further lowered during 1919, and that, except where contracts between employers and employees provide for a sliding scale, no reduction in wages was to be expected. The assumption is that the new prices are about as low as the industry can stand with the present scale of wages. Since it is generally recognized that reductions in wages, if they come at all, will be made with great deliberation, there is little reason for the buyer of iron and steel products further to delay purchases in the hope of lower prices.

National Ship Policy Announced

In a speech delivered at New York on March 27 before the National Marine League, Mr. Edward N. Hurley, chairman of the United States Shipping Board, announced his plan, which presumably has the support of the Administration, for the operation of the ships the Government has built and is now building. Probably the most important part of the entire announcement, and something that will be a great relief to ship-owners and businessmen in general, is Mr. Hurley's statement that he is opposed to Government ownership, except as a last resort. Instead, he proposes that the ships be sold to American citizens at "a price that fairly reflects the current world markets for similar tonnage." In other words, the Government is prepared to write off the excess war cost of the ships. The terms are to be one-fourth cash and the balance payable over a period not exceeding ten years, with interest at 5%. The difference between 5% and the current Government rate, which Mr. Hurley erroneously assumes to be 4%, is to go into a 'Merchant Marine Development Fund', the purpose of which is explained later. The purchaser is to insure his equity, and the Government is to carry its own insurance on its interest in the ship, but is to charge the ship with insurance at the regular commercial rate. Any savings that may be made by this practice are to be paid into the fund already mentioned. It is recognized that some ships must be operated on routes that will not produce a fair profit from the start. Owners operating on these routes are to be reimbursed from the Merchant Marine Development Fund. The fair rate of interest to be used as a basis in this computation is not stated. Neither are there any figures to support the assumption that this fund will be equal to the demands upon it. The statements of ship-owners regarding the cost of operation of ships under the American

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flag would seem to show the contrary. However, the plan indicates that the Administration is disposed to approach the whole problem in a business-like way and to co-operate with American shipping men in building up a merchant marine. The rest is not going to be easy, but the right start has been made.

Machinists' Strike Will Compel Closing of Yards

The California Metal Trades Association officially opened its shops on March 27 to competent machinists and boilermakers. It had notified the Iron Trades Council previously that unless that organization furnished sufficient machinists and boilermakers to take the place of the men on strike in violation of their agreement, the Association would take steps to obtain a sufficient number of men to keep the industries going. No reply being received from the Council, a direct appeal was made to the men to return to their jobs as individuals. The terms offered were the 48-hour week and no retroactive pay, the Macy scale of $6.40 a day for machinists and boilermakers, $4.64 for helpers, and $4.96 for machinists specialists.

Fred C. Metcalf, secretary of the Metal Trades Association, issued the following statement:

"The boilermakers and machinists are on strike in violation of the agreement between the California Metal Trades Association and the Iron Trades Council. Article 9 of this agreement says: 'During the life of this agreement there shall be no strike on the part of the employees nor lockout on the part of the employer'.

"The Iron Trades Council showed its disapproval of these strikes by expelling the offending unions from the council. The shops of our members have been closed since February 1 to their great financial loss, and work in the shipyards has been seriously affected. Thousands of dollars' worth of work has been sent to other cities and ship repair work aggregating $600,000 has been turned away from this port as the direct result of these strikes.

"We have tried to adjust the difficulties through the Iron Trades Council, which was the only place we could go under our collective bargain agreement. That body, apparently, has been unable to control these particular unions. As these unions are parties to the agreement only as members of the Iron Trades Council, the only thing left is for our members to make direct appeal to the workingmen."

The trouble between the machinists' union and the employers was caused by the determination of the union to force the 44-hour week on the employers in violation of their agreement. Both the employers and the union agreed to accept the compromise agreement regarding back pay, but the employers outside the shipyards refused to put it into effect with the machinists as long as they continued to take the Saturday half-holiday. On February 7, the machinists in the outside shops struck to enforce the payment of the back pay and the men in the shipyards, who had been given the retroactive pay, continued to take Saturday afternoons off. The position of the shipyards and the outside employers regarding the retroactive pay is necessarily different. The Emergency Fleet Corporation pays the retroactive wages in the yards, while the outside employers must pay the retroactive wages out of their own pockets, with no chance of reimbursement. Furthermore, in the compromise agreement, the outside employers did not consent to the payment of any retroactive wage as such. They did, however, agree to pay in installments an amount in excess of the regular wage equal to the retroactive pay from October 1, provided the men worked the 48-hour week and otherwise observed the terms of the original collective-bargaining agreement.

On Monday, March 3, after due notice, the shipyards discharged all men who had laid off the previous Saturday afternoon. Approximately 6000 machinists are out. The International of the machinists' union has brought pressure to bear on the men to work the 48-hour week, but so far without result.

The boilermakers of Union No. 6 in the shops outside the shipyards, approximately 200 in number, struck February 1, demanding retroactive pay to August 1. The Union refused to abide by the compromise agreement between the California Metal Trades Association and the Iron Trades Council and was expelled from the latter organization of which it was a member. This strike was sanctioned by the International Union, in spite of the fact that the collective-bargaining agreement is being violated, and the strikers are getting a total benefit of $20 per week from that organization and their own local.

At the time of going to press, the conference in Washington between representatives of the Fleet Corporation, Shipbuilders and Unions had not been able to come to a conclusion in the discussion of a new working agreement and of the establishment of a conciliatory board to handle labor disputes owing to the deadlock caused by the insistence of the machinists on the enforcement of the 44-hour week in violation of their agreement. The Shipping Board has, however, guaranteed the Macy scale up to October 1 on Government work.

The shipyard laborers, coppersmiths, riggers, and sheet-metal workers union, numbering about 1000 men, are also out to enforce their demand for the 44-hour week. Their position is identical with that of the machinists' union.

At a meeting of the California Metal Trades Association on March 29, it was decided to close the shipyards unless machinists in sufficient numbers to carry on the work returned to the yards at once. A committee of employers will shortly set the date for closing the yards. Rather than bring in men to take the place of the strikers, with all the attendant evils that would result, the employers prefer to close the yards until the men are ready to return. The strike of machinists effectually ties up the work of the other crafts and will cause thousands of men to be laid off. Already 70% of the foundry employees have been laid off because of the strike.

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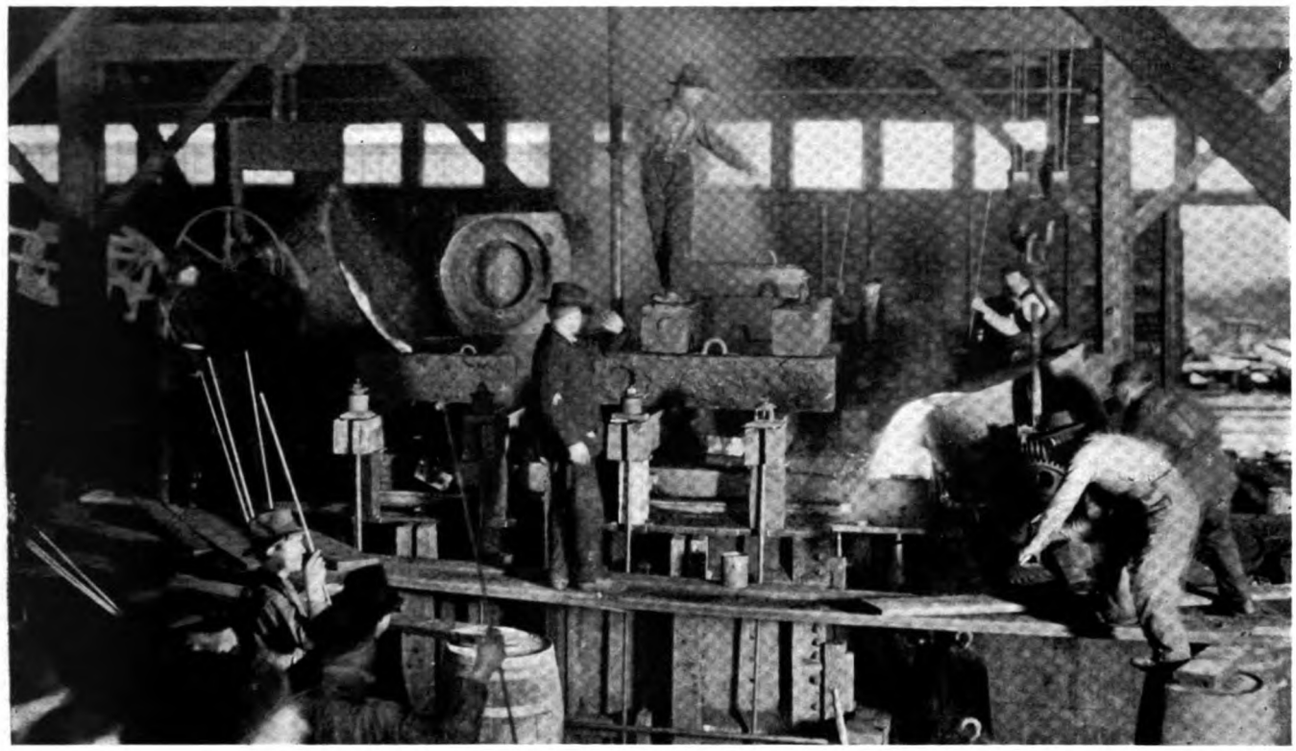

POURING THE 29,000-LB. LOW-PRESSURE CYLINDER CASTING

Manufacture of Marine Engines at the Joshua Hendy Iron Works

By H. S. REXWORTHY

ENGINES weighing 100 tons and developing 2800 hp. are being delivered at the rate of one every 30 days from the Hendy plant. The largest casting weighs 14½ tons. Building these engines called for considerable addition to the company's plant and for the building at the company's own plant of several pieces of special apparatus for the machine work. Mr. Rexworthy is chief engineer for the company.

ONE of the most important parts of the shipbuilding program for the Emergency Fleet Corporation is the construction of the engines and auxiliary machinery. Gray-iron and steel foundries, forge-shops, and machine-shops all over the country have been working overtime in order that there should be no unnecessary delay between the completion of the hull and the delivery of the fully-equipped ship. Among the Pacific Coast plants that have devoted a large part of their energies to this work is the Joshua Hendy Iron Works.

The main offices of the company is in San Francisco and the works at Sunnyvale, where the company owns a tract of land large enough to permit of almost indefinite plant expansion. The company has a contract for the delivery of a number of 2800-hp. triple expansion reciprocating engines. The engines are being placed as completed in the ships built at the Schaw-Batcher Co. yard at South San Francisco. All the foundry and machine work is done by the Hendy company. Forgings are furnished by the Edwin Forrest Forge Co., of Oakland. Line-shafting is obtained from various Eastern manufacturers. The stern-frames and propellers, which are steel castings, are made by the Columbia Steel Co. of Pittsburg. The other steel castings are made by the Best Steel Casting Co. of San Leandro.

Arrangements for the construction of this machinery were made with the Emergency Fleet Corporation early in 1918, and in May work was under way on extensions

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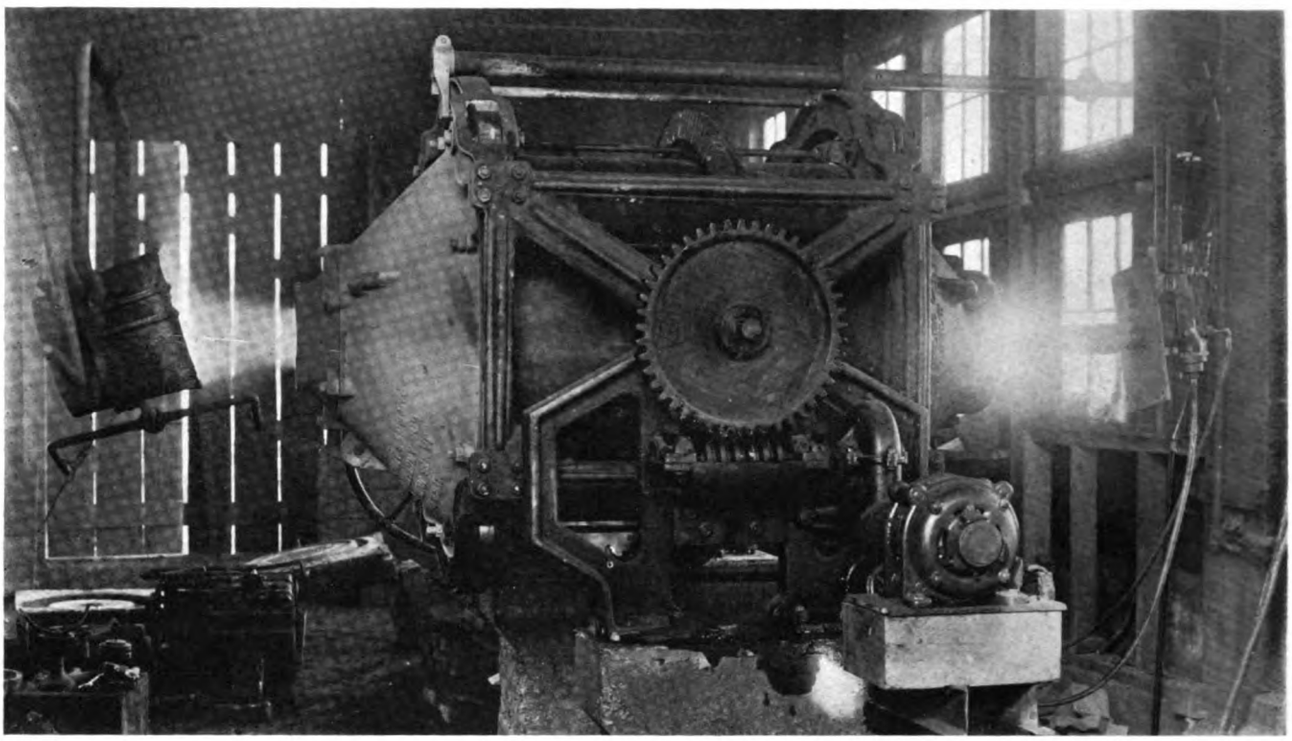
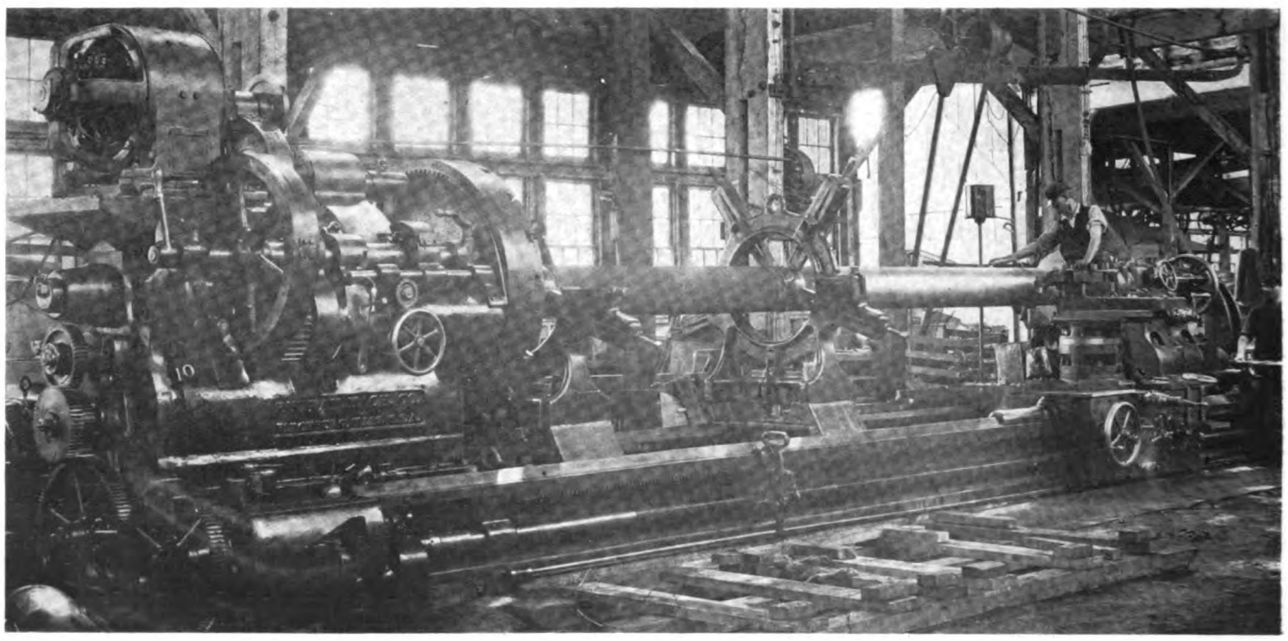


ROTARY BRASS-FURNACE IN OPERATION

to both the foundry and the machine-shop, as the original equipment was inadequate for the work to be done. The extension to the foundry consisted of an addition 80 by 200 ft. long, making the total size of the foundry 80 by 450 ft. In addition to the two existing cupolas, each of which has a capacity of about 6 tons of metal per hour, a new cupola with a capacity of 12 tons per hour was erected. This latter cupola is unusually rapid, iron being frequently produced in nine minutes from the time the blast is put on. To charge this and the other cupolas, a special loading platform with a capacity of 100 tons was constructed. Material is lifted to this platform by a special hydraulic elevator. The material is loaded on specially constructed trucks, raised to the platform, weighed, and charged into the furnace without re-loading. New equipment for the foundry also includes an oil-fired rotary brass-furnace, and three core-ovens, the larger two being 12 by 22 by 10 ft. high.

An extension 80 by 225 ft. long was constructed for the machine-shop, making the entire shop 80 by 625 ft.



TURNING SHAFT

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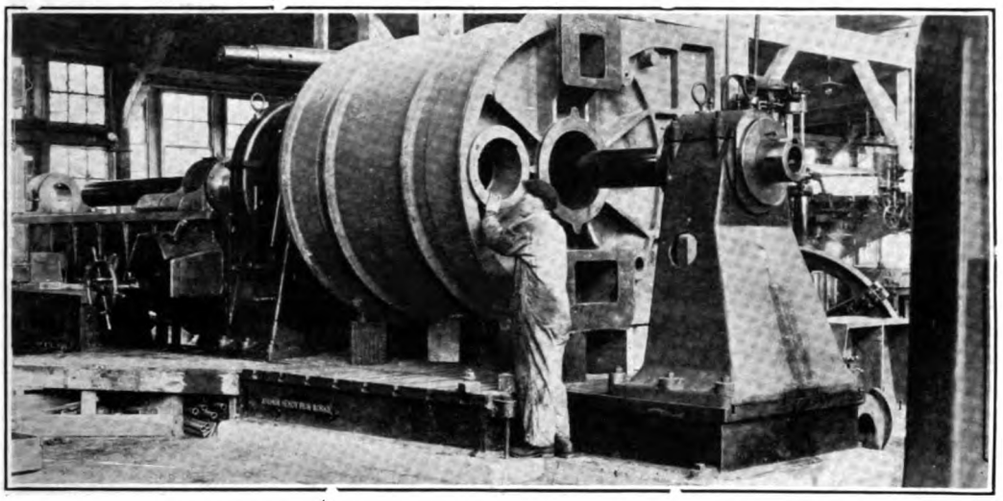
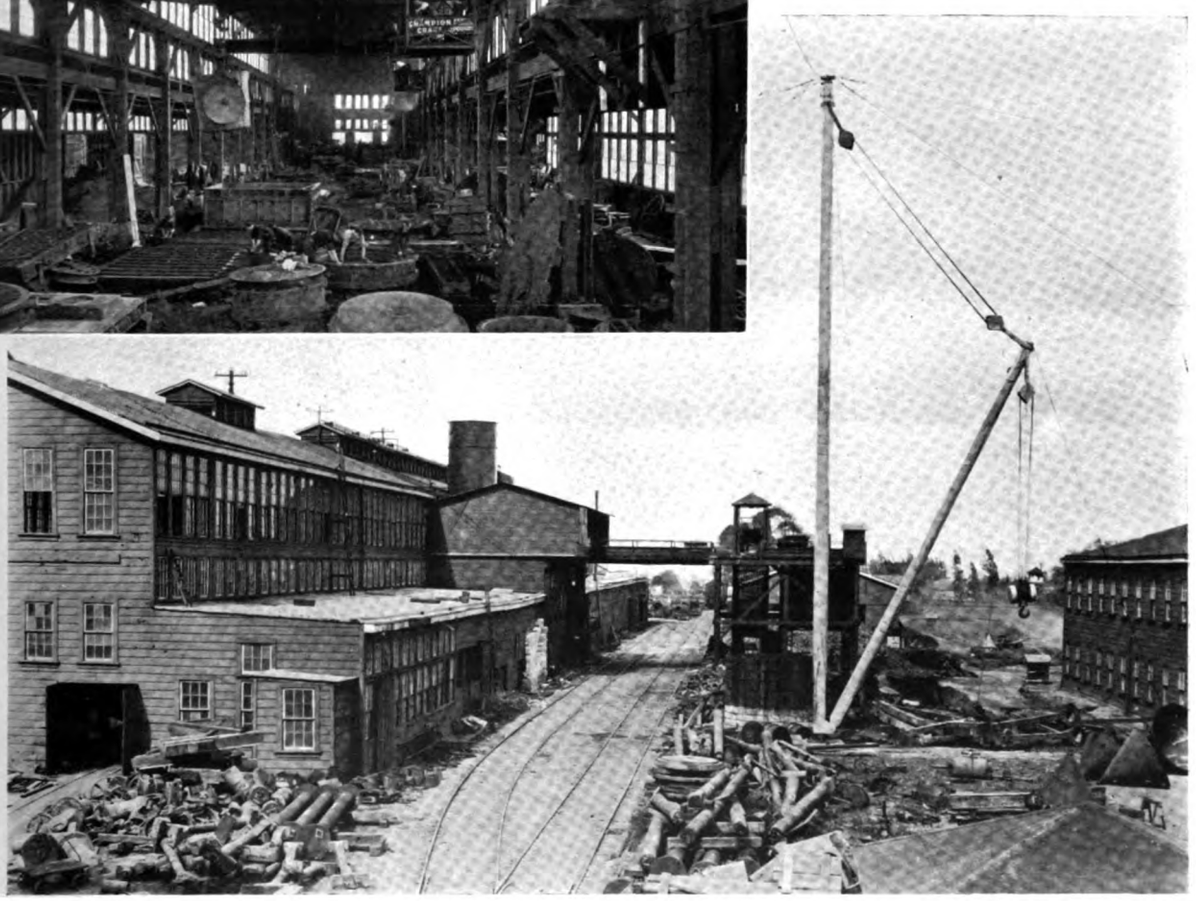


BORING LOW-PRESSURE CYLINDER ON SPECIAL BORING-MILL

The old part of the shop is now used exclusively for machine work, the assembly department being moved to the extension.

The floor of the extension is of concrete and was placed 5 ft. below the remainder of the shop in order to give additional height necessary for the assembly of the engines. Accurately machined cast-iron leveling rails are provided throughout the entire length.

The engines are 48-in. stroke. The cylinders are, respectively, 24½, 41½, and 72 in. diam. The engines are 28 ft. high overall from the floor, and occupy a floor space approximately 14 by 21 ft. They are designed for



ABOVE, INTERIOR OF FOUNDRY. BELOW, FOUNDRY BUILDING ON LEFT, HYDRAULIC ELEVATOR IN CENTRE, CONNECTING WITH CHARGING PLATFORM BY BRIDGE ACROSS SPUR-TRACK. IN THE FOREGROUND IS A PILE OF MISCELLANEOUS FORGINGS, AND THE SCRAP-PILE.

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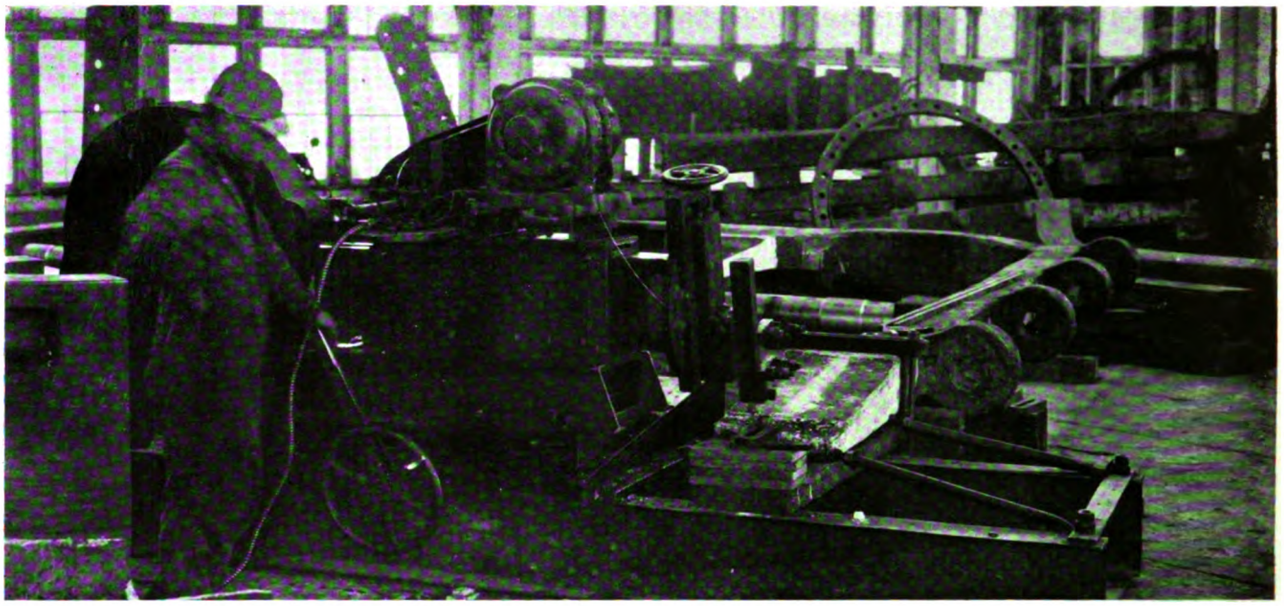


SPECIAL PORTABLE-PLANER FOR SCARFING FRAMES

a piston-speed of 688 ft. per minute and 86 r.p.m. The engines are provided with a vertical 8 by 6-in. turning-engine, worm-geared to the main engine for starting. The valves are actuated by a Stephenson link motion. The total weight of the engine is approximately 200,000 lb., and the weight of the largest casting, the low-pressure cylinder, is 29,000 pounds.

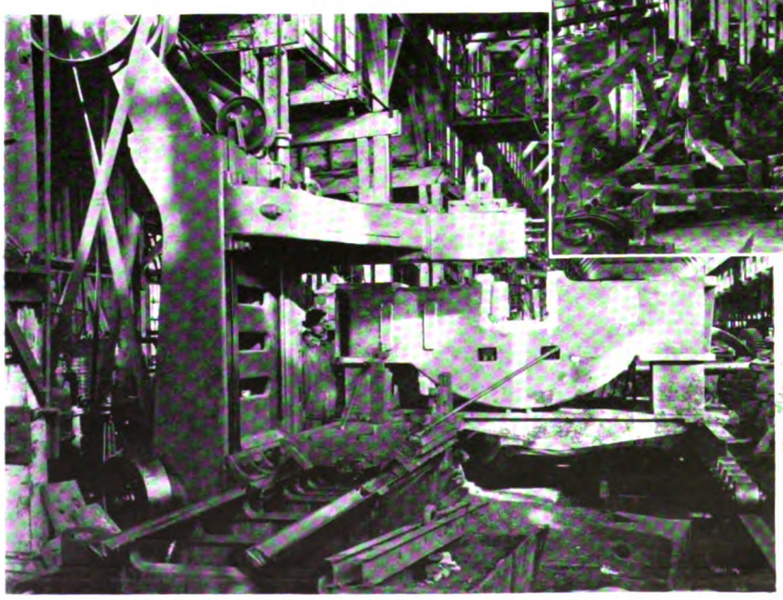
A typical charge for the cylinder castings is composed of car-wheel scrap and high-silicon pig-iron. An average analysis of test-pieces from the cylinders as cast is as follows:

	%
Silicon	1.72
Manganese	0.63
Combined carbon	0.57
Phosphorus	0.502
Sulphur	0.129

A test-bar $1\frac{1}{4}$ in. diam. broke at a load of 4250 lb. with a deflection of 0.13 inch.

Gallagher and Monterey sharp sand are used for molding. The large cores for the cylinders are made of a black-sand mixture, two-thirds burnt sand and one-third new sand, with 1 part core compound to 60 of the mixture. The steam-port and steam-passage cores are made from a flour-sand mixture. In molding, the low-pressure and intermediate cylinders are made in one box without cheeks. The high-pressure cylinder is made in one cheek. Three large concrete floor-pits have been constructed in the foundry in order to mold three cylinders at a time without interference from the other work. To handle these and other heavy

GENERAL VIEW OF MACHINE-SHOP



FACING ENGINE BED-PLATE

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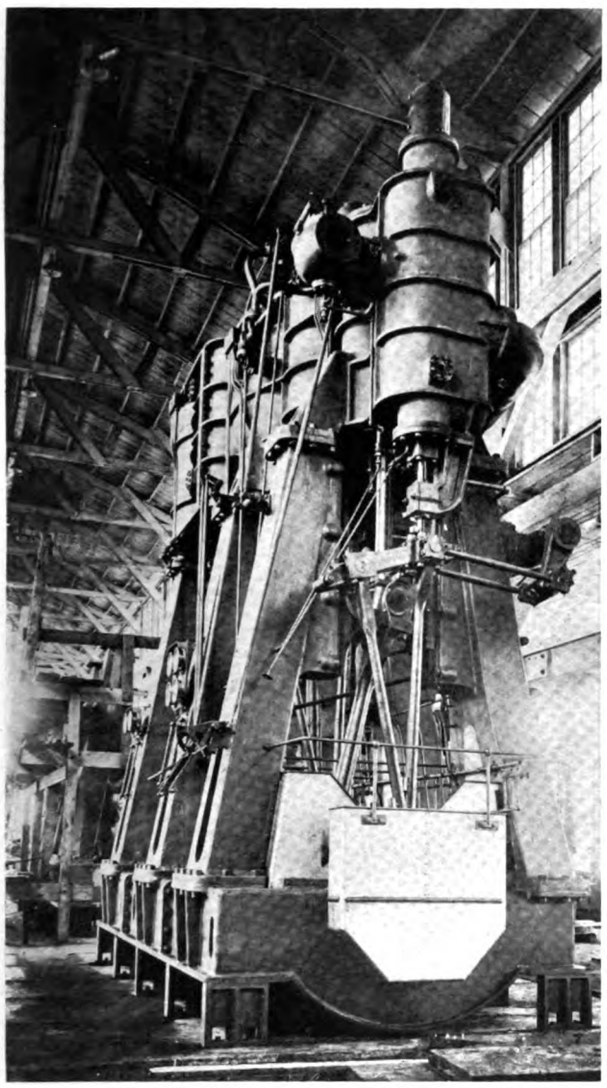
castings the foundry is equipped with two 10-ton and one 25-ton electric traveling cranes.

From the foundry the large castings are loaded on standard-gauge cars and taken to the machine-shop, the company's spur-track running at right angles to the length of the shop, and crossing it near the middle. The traveling-crane equipment of the machine-shop comprises one 10-ton Niles crane, one 15-ton Case crane, and one 25-ton Champion crane, the last being added particularly to handle this engine work. The forgings and steel castings are also delivered on this spur-track along



COMPLETED ENGINE ON ASSEMBLING-FLOOR. IN BACKGROUND, SCAFFOLDING FOR ANOTHER ENGINE

with other material, and stored until needed either in the yard, the warehouse, or the main aisle of the machine-shop. The specifications for the steel castings call for a minimum strength of 58,000 lb. and a maximum of 78,400 lb. per square inch, with an elongation of at least 20% if broken at 58,000 lb. and at least 15% if broken at 78,400 lb. The forging specifications call for a strength of 60,000 to 78,400 lb., and elongation of 30% at 60,000 lb. or 22% at 78,400 pounds.

For much of the machine work special equipment had to be obtained, and, on account of the difficulty of obtaining deliveries at the time the work was started, this meant, in many cases, constructing the necessary tools on the ground. One of the most interesting of these tools is a horizontal boring-mill that can handle cylinders up to 90 in. diam. This mill was designed and built in about 90 days. The main boring-bar of this machine has a diameter of 12 in., and is 28 ft. 6 in. long. It is provided with 16 speeds in order to give the most suitable cutting-speed in boring work from piston-valve bodies to large cylinders. This mill has been operated 24 hours per day for the past six months, and has given excellent satisfaction. Another special tool is a lathe that swings 84 in. and is 26 ft. between centres. The total weight of this machine is 50 tons and it is operated by a 35-hp. direct-current motor controlled from the apron. Most of the tools are operated by alternating current and the cranes are operated by direct current.

This lathe is used mainly for turning the three-throw crank-shafts for the main engines. These shafts are of the built-up type, with cast-steel webs. These webs are shrunk on the 15-in. shafts and are forced into place by means of a pneumatic cylinder provided with a piston-rod and head placed horizontally on a large surface-plate provided with angle-stops. The heated crank-web already in position is moved forward by the pneumatic apparatus in one stroke and each web is shrunk in its respective place in rotation until the assembly is completed. The principal advantages of this method are the rapidity and the accuracy of the work.

As already stated, the assembling of the engines is done in the extension of the machine-shop built for the purpose. Three engines are assembled at one time. The first engine was completed about 90 days from the time work was commenced, and deliveries are now being made at the rate of one every 30 days.

Another interesting machine, built specially for the work by the company, is a portable planer for scarfing stern and other frames. On account of the awkward shape of these frames, much time would have been lost in bringing these frames to any of the regular machines, so this portable planer was devised, and good results have been obtained from it.

Besides the larger engine parts, the company also makes all the valves required. During the period when deliveries were most delayed, it was even found advisable to make the nuts for bolting the parts together.

In order to facilitate the work, jigs are prepared whenever they can be used to advantage, and a special room is devoted entirely to storing them. Some of these jigs weigh as much as one ton.

All the additions and alterations to buildings and the installation of new equipment had to be done with a minimum of disturbance to the regular operations at the works, and this, in itself, formed no small problem. The company has also continued its construction of mining machinery.

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Design of Heating-Furnaces for Forging and Press Work*

IN designing a furnace for heating heavy ingots for forging and press work, the stock is usually brought to a temperature of 2000 to 2100°F. If it is special alloy-steel the heating conditions are considerably different from those required for ordinary material. Special alloy-stock is charged into a practically cold furnace and brought to working-temperature gradually, to prevent, as far as possible, surface-cracks. When surface-cracks do appear the temperature is then brought up to a wash heat or welding heat, whereby the cracks can be readily closed. It is preferable, from the manufacturer's standpoint, to use a furnace in which a wash heat can always be procured. With certain stock of alloy-steels, such as billets and slabs that can be rolled, a continuous furnace would be ideal, as the charging-end of this type of furnace is usually around 700 to 800°F., but the ordinary continuous furnace cannot be used on account of not being able to procure a wash heat and at the same time prevent the stock from coming in contact, which would naturally result in it freezing or welding together.

In designing a heating furnace for heavy work—for instance, a furnace used by such concerns as the Erie Forge Co., where it is common practice to heat ingots up to 62 in. diam.—the design must be such that the stock, which is often of considerable length, can be heated in sections. This requires a furnace of considerable height so that the flame or gases can pass below the stock as well as above it. The time required to heat material of this size is figured in our office in the following manner and based upon actual practice. An ingot 62 in. diam., having a radius of 31 in., requires the furnace temperature to be maintained at around 2000°F. This temperature will permeate to a depth of ¼ inch in five minutes, and 31 in. being equivalent to 248/8, this multiplied by 5 would give 1240 minutes—or 20 hours and 40 minutes. I find that with a stoker-fired furnace, the fuel consumption for this class of work runs between 700 and 750 lb. of coal per ton of product. This rule holds good for all heavy stock. In order that the ingot may be heated in sections, a large opening is provided on each side of the furnace. The ingot is set on a pedestal-support on the outside of the furnace. If the end is to be heated, a cast-steel block is placed on the hearth for end-support. Doors are not used on this type of furnace; but after the ingot has been charged, the openings of the furnace are closed with brick and sealed. For work of this nature a 12 to 18-in. space is allowed between the ingot and the hearth, and a 10 to 12-in. space between the top of the ingot and the crown. If the ingot is of smaller diameter than the maximum size for which the furnace is designed, the extra space is left at the bottom instead of at the top. There are no special features connected with the design of this type of furnace, except that the combustion area must be sufficient to heat readily the maximum-sized stock. A waste-heat boiler is usually built in connection with this type of furnace, and provision made to by-pass the boiler, so the furnace can be operated independently when desired.

There is a type of heating-furnace used for forging and press work, which was designed for 16 by 16-in. ingots. Instead of this furnace being charged or drawn until it was either full or empty the hearth can be kept full at all times—that is, immediately after a hot ingot is withdrawn, a cold one is charged to take its place, thereby utilizing the hearth area continuously; precautions being taken to prevent a cold ingot affecting a hot one. A common hearth-furnace was used, with a continuous bridge-wall at the rear and one common combustion-chamber beyond the bridge-wall. The front of the hearth is provided with three or four doors and a partition-wall run straight through the hearth of the furnace from the centre of each door-jamb to the bridge-wall and up to within a few inches of the skew-back line; thus dividing the hearth into compartments, with one common crown over all three or four compartments. These dividing-walls prevent a cold ingot from having any effect on a hot one that is ready to draw.

*Extract from paper presented before the Engineers' Society of Western Pennsylvania by George J. Hagan.

Skin Infection From Cutting-Compounds and its Prevention

A recent bulletin of the U. S. Department of Labor gives the results of an investigation by Anna B. Yates of the causes and prevention of skin irritation and wound infections prevailing among workers on machine tools where a cutting-compound is used. It is believed that infection follows lessened resistance of the skin to various bacteria due to the irritant action of the oil and to a lack of personal cleanliness. While admitting that the problem of infection from cutting-compounds is far from being completely solved, the author recommends as preventive measures keeping the cutting mixture free from outside contamination and filtering it frequently, thorough cleansing of the hands and forearms of the operator at least twice a day, and changing overalls at least twice a week.

Lists of Importers in the Orient

The Bureau of Foreign and Domestic Commerce has compiled the following lists, copies of which may be obtained from the branch offices of the Bureau by referring to the file numbers:

	File number
Importers of hardware at Hongkong	9565
Engineering, contracting, and construction firms at Bombay	9582
General importers at Manila	9497
Hardware dealers in Straits Settlements	9569
Importers of machinery at Batavia	9559
Importers of iron and steel at Batavia	9560
Importers of brass and copper at Batavia	9554

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Side-Lights of the Selective Draft

THERE has recently been issued from the Government Printing Office at Washington, an interesting human document entitled 'Second Annual Report of the Provost Marshal General'. While it contains a large quantity of dry statistics, which must necessarily be preserved as an historical record, but which no one will ever read unless he is obliged to do so, on the other hand, unlike most government documents, it has been lightened by the inclusion of many extracts from letters of local draft-boards, which make the body of the report not only readable but enjoyable.

One of the features of the 'Work or Fight' order is illustrated by the following:

"We had one registrant who professed that it was against his religion to work. He certainly lived up to his religion, too. He was always loafing around on the streets or in the pool-hall. His father was forced to support him or turn him out, and chose the former. His friends and relatives had tried to persuade him to go to work, but in vain. Finally the draft came along, the idle one was registered, and classified. One day the father came into the office and told us about the boy, which was quite unnecessary, as we were entirely familiar with the situation. He asked us if we could not help him out and try to get the boy to go to work. We told him that we would try. So the next day we served a notice on the boy, 'You will either have to go to work or fight'. He looked at us quite calmly, and said 'D—— the work. I'll fight.' Just then a call was issued; so we inducted him and sent him to fight. We later learned that he had developed into an excellent soldier."

Allied to the 'Work or Fight' question, but differing from it in certain details of application was that of dependency.

"The humdrum of the every day duties of the board members was broken by a woman appearing at headquarters leading a man. She asked for the chairman, and then to see the questionnaire. Turning to the 'Waiver', she directed Jim to 'sign here' and then attached her name below his signature. She then demanded physical examination blanks and the way to the examining room. The chairman at this juncture ventured to ask the reason; for Jim had a wife and two children. The answer came immediately: 'My man sits around all day while I take in washing to support him and the kids. I'm getting tired of it, and he's going to war, where he will support himself.' In 30 minutes she returned with the examination papers and Jim. His examination was 'O.K.' She then inquired when the next contingent left for camp. Upon being informed that it was the next day at 3 o'clock p.m., she departed, saying: 'We'll be here.' She and Jim were duly on hand; and Jim didn't get out of her sight until the train disappeared from view at the station. Her parting remark was: 'Jim, don't you dare come back until the War is over!' Jim didn't."

"An old negro mammy of 'befo' de war' type overheard her son-in-law, who had deserted his wife, trying to get her to come in and make the oath as to dependency. The old mammy took charge of him and brought him up the next morning, and, with fire in her eyes, told the board: 'Dis nigger is a liar, and I says it to his face, and I fotch him here to tell you. He haint gin my darter de rappin of your finger in two years, and las nite he come dar axin her to hep him, and I locked him up and fotched him here.' He was asked what he had to say. He looked at his mother-in-law, and then thought of the German bullets; and with beads of perspiration on his face said that he would join the Army."

The desire to get into the service in spite of obstacles was nowhere so well exemplified as in the unexpectedly large number of men that registered and gave their age as 45. Undoubtedly, many of them purposely understated their ages. Other men over age even represented themselves as being under 45.

"X registered on September 12, 1918, and gave his age as 35 years. He was mailed a questionnaire and took it before the legal advisory board, intending to fill it out, but it appearing to the attorney before whom he went for assistance, that he was far beyond the draft age, he was refused assistance in filling out his questionnaire, and was told to report to his board. He did report to the board and admitted that he was 58 years old. On being questioned why he registered, he stated that he had made three attempts to get into the service and had been turned down. He hoped that his registration would open a way for him to get into the service. He begged the board member, with tears in his eyes, to put him down at not over 45. He offered, as proof of his physical fitness, to whip anyone in the house. Nevertheless, his registration was canceled."

But the heroism of the drafted men and also of their relatives is well-known and will live in history. The heroism of the local draft-boards will, we fear, remain unsung except in a few documents like the present report. In spite of many discouragements they good-humoredly proceeded with their task. Sometimes even the courts tried to interfere with them. This is what one board did under such conditions:

September 2, 1918.

"Dear Sir: Our chief clerk says that you telephoned for a report on the X cases, which were in the United States district court. We would have written sooner but were in the United States court Friday from 10 a.m. till 4:30 p.m.; also on Saturday the board was there till 1 p.m., after which we had 42 hearings for the evening, which we finished at 11 p.m.; these cases involved the

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questions as to whether the condition occurred according to the new rulings as mentioned in the seventy-fourth section of the two hundred and eleventh amendment as embodied on the second page of the one hundred and ninth Bulletin; if we heard these cases the way they do in the United States court, we wouldn't have finished them in 26 years.

"John X's case was dismissed by the court in our favor at 1 p.m. Friday, August 23; John was inducted at 7 a.m. August 26; he failed to report, and the same afternoon was reported to the police as a deserter; at 9 p.m. we were served with a writ to show cause, etc., and stop further proceedings and come down to the Federal building in the morning. We went down the next morning, and the United States court said to withdraw the order of arrest, as John was not a deserter. We said he was. The court said he wasn't. We said he was and the United States attorney said he was, Capt. A. said he was, and Inspector B from the Adjutant General's Office said he was; so we telegraphed to Washington for instructions. John was given into our custody in the courtroom Saturday at 1 p.m. We still held he was a deserter, and took him right up to your office. Capt. C. held that it was up to the board whether he was a real deserter or a nonwillful delinquent. Neither Capt. C. nor Capt. A. offered to feed him, and the Government has given us no allowance for meals (or for anything else since last February). So we took John over to Main street at 1:15, and paroled him in his own custody so he could buy his own dinner. He reported back to the board at 5 p.m. (These fellows are big eaters.) John is now at Camp Gordon, Georgia.

"James X was previously brought down from Fort Blank by a lieutenant. His case was dismissed in our favor at 4:30 p.m. on Friday, and he is now back at Fort Blank. Jim's case was a habeus corpus. John had a certiorari. Joseph X, the last member of the family, has now taken out some new kind of a writ, which we argued some on Saturday morning, but don't quite understand. The United States court reserved decision in this case, but we think it will be finished tomorrow, Tuesday, so that Joseph can go with the band on Wednesday when the 240 boys go to camp. This wipes out our class I.

"P. S. These writs are getting the board all balled up. We are taking a course in 'writs' now, so we can do our bit and help make the world safe for democracy."

More often, however, the troubles of the board-members comprised a number of irritating circumstances, small in themselves, but, when taken together, calling for real patriotism and fortitude. The chairman of one such board wrote as follows:

"Sir: Because this board and its meager staff is so busy

"Counseling registrants.

"Reconciling mothers.

"Patiently answering dozens of inquiries by mail, telephone, and telegraph.

"Issuing permits for passports.

"Writing to transfer boards and telling them what to do with Form 2008-A.

"Making out induction papers for S. A. T. C. registrants.

"Copying our 4439 registration cards.

"Writing up cover-sheets.

"Hunting up questionnaires without order-numbers in order to append additional late-arrival affidavits of the X. Y. Z. Co. for deferred industrial classification in Class II of aliens (who are sure to be in Class V).

"Preparing routings and transportation requests for individual inductants under competent orders, who are to be entrained for Kelly Field, San Antonio, Texas, or Carlstrom Field, Arcadia, Florida.

"Counseling the poor innocents as to 'how many' suits of underwear shall I take?'

"Advising them firmly though with kindness that while requests for tourist sleeping-car accommodations will be issued to them, our experience is that there will be no tourist cars available, and that they will sleep on the floor.

"Preparing seven meal tickets, three copies for each man.

"Issuing new registration cards and new final classification cards to men who have 'had their pocketbooks stolen' (?) and are afraid of being rounded up.

"Issuing certificates of immunity to 46-year old men who present proof of birth date so that *they* won't be rounded up.

"Advising colored ladies (to their manifest satisfaction) as to prospective Government allotments and allowances to come from their casual spouses when in the service.

"Telling anxious Y. M. C. A. recruits how they can apply to have their cases reopened and claims for occupational exemption considered.

"Advising by mail the assistant district attorney of ——— county, who desires to prosecute a registrant for not supporting his wife.

"Trying to keep several thousand questionnaires and registration cards, minus order numbers as yet, out of irremediable chaos due to lack of filing-cabinets or other facilities.

"Reconciling our hardworking limited-service man to writing up his 'daily morning reports' on a form adapted for a full company of men, including mules.

"Conducting voluminous correspondence with perturbed mustering-in officers at distant cantonments about registrants who have been picked up without Form 1007 in their possession and shot into camp without proper induction papers in order that some yap deputy sheriff can get the $50 reward because he needed the money.

"Futilely registering ex-soldiers and sailors discharged for physical disability.

"Getting into a corner occasionally and going crazy trying to study out an abstruse legal problem from an interesting 433-page textbook called Selective Service Regulations, second edition, Form 999-A.

"Classifying questionnaires.

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"Engaging, for physical examinations of several hundred men, doctors who are already bereft of their wits on account of the Spanish influenza.

"Preparing dozens and dozens and dozens of Form 1010 for these examinations, three copies of each.

"Postponing the examinations after all, because the doctors simply can't come, and re-dating all the Forms 1010.

"Doing dozens more things daily and nightly and Sundays and holidays, of which the foregoing are mere samples.

"Because, I say, the board and its meager staff are so busy with a number of such matters, I beg to report

"That, though probably about half the questionnaires of the 'First series, registrants of September 1918' have been classified, we haven't time or inclination or energy to count them, even approximately; about half the physical examinations have been concluded, and on Sunday we are going to try to catch up with our correspondence, if the master-list doesn't come, which we presume it will, however, in which event, we hope to have four volunteer typists pound out five copies of Form 102 (the churches are all closed, so it won't matter), and, anyhow, we lost the 'Progress chart' the very day it arrived. And it is our opinion, if we may be permitted the liberty to express it, that what the Government wants (or ought to want in the present urgency) is men, not classifications, and we firmly believe that the boys on the firing line in France don't care a whoop in hades how many registrants of Local Board No. 3 of Union county classifies in Class V or in Class IV, Division A, so we called out every man who made no claim or who waived all claims, or who had a manifestly insufficient claim, classified him at once, and called him for physical examination; if it were not for the blasted epidemic, we should be ready to report practically full completion of physical examinations now; but we shall be in any event, within a week, even if we explode in the attempt and incapacitate for all time the few remaining distraught doctors that are still available to cajolery and patriotic urging; in the meantime, we shall classify now and then, when we can, an alien or two, and a few others, to swell our general list of classifications.

"The fact is, we have been wanting to write this letter since we were appointed in May 1917; so excuse it, please. Furthermore—and we say this in no mood of rancor or in undue pride of spirit—we don't care if you do send it to the Provost Marshal General. In fact, we wish you would. No more benevolent attention could accrue to members of local boards than the gentle joys of court-martial and cool retirement somewhere in nice quiet cells, fed and cared for, during the period of the balance of the Emergency.

"And further deponent sayeth not (because his wife has just telephoned as to why the deuce he doesn't come home, he'll surely be sick), and will now quench the midnight shining bulb and go, and try to get around early in the morning and endeavor to find that lost 'Progress chart' (drat it!)"

Testing Toughness of Steel and Other Metals

In a paper recently presented before the American Institute of Mining Engineers, Samuel L. Hoyt called attention to the fact that the ordinary tension and impact tests including the determination of elongation and reduction of area were insufficient to determine the toughness of a given material under certain conditions. In particular, what may be called the notch-toughness is not measured. The principle of notch-toughness, or lack of toughness is used by the blacksmith when he notches a bar at the point where he wishes to break it, and then breaks it with a blow that would have only slightly bent the un-notched bar. There are many instances of parts of machines where the material is used in a notched condition, such as the key-seat for an axle and most 'shoulders'. Sometimes this notched condition may be avoided by different design or workmanship, but where this cannot be done it is important that the material used possess notch-toughness. The best way to determine this notch-toughness is by the Charpy test, suggested by the French engineer, Georges Charpy. In this test, a notch is made in the test-bar, which is then placed on two supports close together, with the notch down and unsupported. A standard weight is then dropped on the bar and when the bar is broken, the product of weight times height of fall is a measure of the notch-toughness. Instances are given where in the case of ordinary steels, one which had been forged correctly and the other incorrectly, the ordinary tests showed ultimate strength, elastic limit, elongation, and reduction in area to be equally satisfactory, but the correctly forged specimen gave a notch-toughness nearly five times that of the poorly forged one. Some nickel and chrome-nickel steels gave results under the ordinary tests only a little better than the poorly forged carbon-steel specimen, but showed nine times the notch-toughness.

He was a very small boy. Paddy was his dog, and Paddy was nearer to his heart than anything on earth. When Paddy met death on the turnpike road the boy's mother trembled to break the news. But it had to be, and when he came home from school she told him simply:

"Paddy has been run over and killed." He took it very quietly. All day it was the same. But five minutes after he had gone to bed there echoed through the house a shrill and sudden lamentation. His mother rushed upstairs.

"Nurse says," he sobbed, "that Paddy has been run over and killed."

"But, dear, I told you that at dinner, and you didn't seem to be troubled at all."

"No; but—but I didn't know you said Paddy. I —I thought you said daddy."

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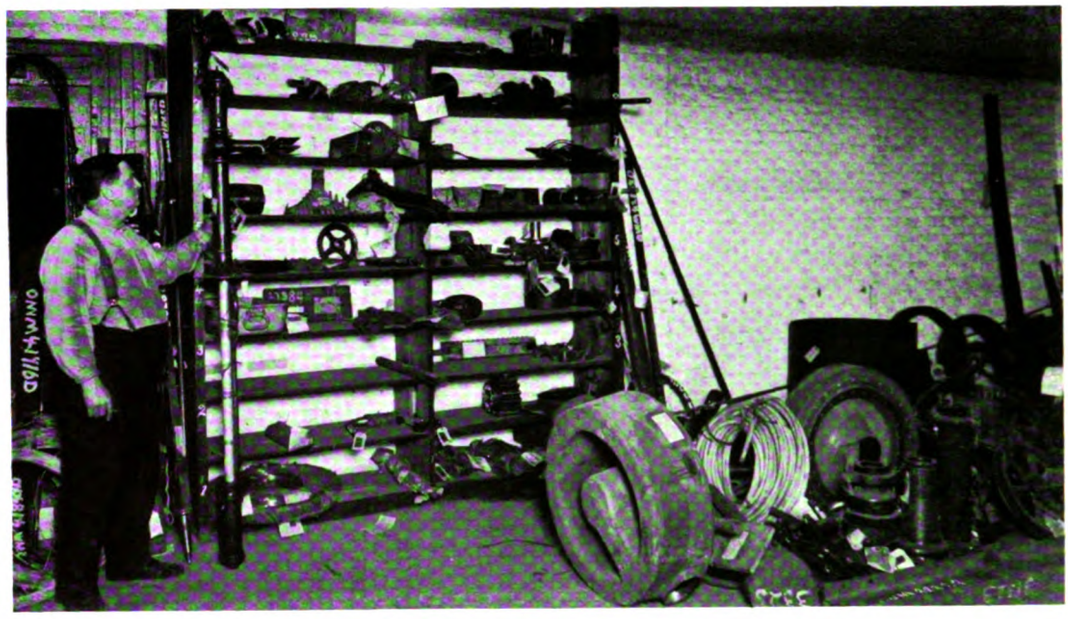

VARIOUS WAYS OF MARKING MACHINE PARTS AND OTHER METAL SHIPMENTS

Proper Marking of Express Shipments

By STANLEY W. TODD

LARGELY because of insufficient or incorrect addressing, many shipments made by express by firms in the metal trades have failed of delivery and instead of being sent to destination, have had to be consigned to 'No Mark' bureaus, maintained by the express company. The expressmen have not been able to deliver these shipments, which in the aggregate amount to a considerable number, because with tags torn off, labels removed, and no stencil or other marks on the shipment, all means of identification has been lost.

From July 1 to November 30, 1918, 127,859 shipments, an average of 25,500 per month, were sent to the 'No Mark' bureaus in various parts of the country, because the essential information as to destination or ownership was missing. Nearly half of these lost shipments were classified as 'hardware', such as castings, machine parts, and other articles made of metal. In September the total reached 26,948, 42% or 10,952 being 'hardware'. It was to eliminate this 'No Mark' evil that the American Railway Express Co. recently began a nation-wide better-packing and better-marking campaign. Careful investigation showed that much of the trouble was due to carelessness on the part of shippers in not preparing their goods so as to stand ordinary handling in transit, while the omission to mark them properly frequently causes them to go astray.

The miscellaneous character of the 'hardware' shipped by express makes it difficult to determine the destination after shipments of this kind are consigned to a 'No Mark' bureau. It is difficult to identify many of the shipments, particularly when they form integral parts of machines and not readily recognizable. Two people never describe the same missing shipment in just the same way and photographs alone can give a clear idea of the appearance of a certain article, in order to identify it in tracing. The bureaus do efficient work, however, in matching shipments with complaints and claims, but the express officials are trying to eliminate this expenditure of time and money, and devote it to constructive work and the improvement of the express service.

Express officials have prepared the following simple rules for marking express shipments from the metal trades:

Show shipper's name and address.

Place plain legible addresses on each piece of each shipment.

Place address directly on shipments by use of crayon (not chalk), brush, or stencil, if possible to do so.

Erase old marks of any description.

C.O.D. shipments. Shipper's name, street, and number, amount of C.O.D., and C.O.D. number of invoice number, should be plainly shown on shipment and on C.O.D. envelope. These envelopes to be so attached that they can be removed at destination without mutilation. They are the envelopes used for return of money-order and must, therefore, be in mailable condition.

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Avoid the use of tags whenever possible, but if not possible, do not let a shipment go out with less than two tags.

In marking metal shipments, express officials suggest that particular care be taken to see that marks are placed on castings or other shipments directly on the consignment by brush or stencil. The paint should be thoroughly dried before the shipment is given to the express-driver. If direct marking is not possible, two strong tags on each piece should be attached to some unexposed part of the casting. Always place an additional mark on an article sent crated, so that if the crate is broken the article will still bear the correct address.

Perhaps the best directions for addressing metal shipments are given in Rule 30, of the 'Official Express Classification', the standard that shipments of this character are expected to reach when being prepared for express handling. Here are the directions for marking shipments of 'Castings, machine-parts, shafting, pipe, rods, bars, and other metal articles':

"Shipments wrapped in paper, or packed in boxes, crates, barrels, corrugated paper, or fibre-board containers, must be marked with pen, brush, stencil, waterproof crayon, or by label securely attached with glue or equally good adhesive.

"When not boxed, barreled, crated, or trussed, and if there is sufficient smooth surface for the purpose, the address must be plainly marked on the article with durable paint. Such shipments must not be accepted unless marks are thoroughly dry.

"When not boxed, barreled, crated, or trussed, or when not possible to mark as provided in preceding paragraph, shipments must be marked with not less than two wooden, leather, metal, cloth, rope-stock, or sulphite fibre-tag-board tags. Rope-stock or sulphite fibre-tag-board tags may be either wholly of sulphite or rope-stock or a combination of both, must test not less than 14 point, have reinforced metal eyelets, and must be attached by wire wherever possible to unexposed parts of the article in order that they may not become detached in handling.

"When tags are used for marking rods, shafting, bars, pipe, iron bedsteads, automobile springs, and other articles of like character, shipped singly or in bundles without packing, there must be two tags, conforming to specifications of paragraph No. 3; both tags securely attached to the article by wire not less than 23-gauge or strong cord; one tag to be concealed by being bound to the article with a burlap covering, the latter securely fastened at each end.

"When metal articles are shipped in sacks, the address must be shown on tag conforming to the specifications in paragraph No. 3, attached either by wire or strong cord, and an additional tag bearing the same address must be enclosed in the sack."

The firm of Cammell, Laird & Co., Ltd., of Liverpool, is building a welded ship. The vessel will be of the coasting type, 150 ft. long, with a capacity of 500 dead-weight tons. It will have Diesel engines, of the Cammell-Laird-Fullagar type. This is a low-speed engine, and the piston loads are so balanced as to minimize the stress on the framing.

Purchasing Power of South American Countries

An article appearing recently in 'U. S. Commerce Reports', by Philip S. Smith, trade commissioner, calls attention to the fact that consideration other than population affect the total purchasing power of any given country in South America. These countries are most of them in the pioneer stages of development, and the desire for modern luxuries, or even conveniences is not yet as strong as in other parts of the world. Moreover, wages are low, while the prices of imported articles are necessarily higher than in the country of their origin, so that many things are out of reach of most of the inhabitants, even if they were educated up to using them. The following table, besides area and actual population, gives the the equivalent population in the United States with the same buying power. The criterion for this buying power is the purchases of electrical goods, but a similar proportion would hold for other manufactured goods.

Countries	Area, square miles	Population	Equivalent population in United States
Argentina	1,153,400	8,000,000	3,250,000
Bolivia	514,464	2,535,000	200,000
Brazil	3,301,950	25,000,000	2,800,000
Chile	290,000	3,800,000	760,000
Colombia	494,340	6,000,000	55,000
British Guiana	89,420	300,000	6,000
Dutch Guiana	46,352	90,000	.....
French Guiana	31,550	50,000	.....
Ecuador	275,331	1,500,000	50,000
Paraguay	164,090	750,000	30,000
Peru	680,000	4,500,000	100,000
Uruguay	72,057	1,250,000	85,000
Venezuela	394,154	3,000,000	75,000

First British Concrete Steamer Launched

The first concrete steamship built in a British yard was launched on January 7, 1919, from the works of the Ferro-Concrete Ship Construction Co., Ltd., at Barrow-in-Furness near Liverpool. The specifications are as follows: Length between perpendiculars, 205 ft.; molded breadth, 32 ft.; molded depth, 19 ft. 6 in.; draft when loaded, 15 ft. 6 in.; indicated horse-power, 400; speed, $7\frac{3}{4}$ knots. The vessel will be equipped with a wireless installation, and the deck equipment for handling the cargo will include three 3-ton derricks, three steam-winches, and a steam-windlass on the forecastle. Two boilers of the marine type are provided, each 9 ft. long by 9 ft. 6 in. diam. The engines, which are of the compound surface-condensing type, will have a capacity of from 350 to 400 hp. at a working pressure of 130 lb. per square inch. The capacity is 1150 dead-weight tons.

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A Parable

BY AN OCCASIONAL CONTRIBUTOR

NOW it came to pass in the second year of the reign of Woodrow the second, that the enemies of our country were completely encompassed and threw down their arms saying "Mein Gott" and also "Mein Himmel." "Yea, verily, even though we might have had a chance against a part of the world; when the 'Yanks' who are numbered as the leaves of the trees came against us it was even time to repent and capitulate and give up already yet."

Up to this time there was great activity among the artisans of the Yankee nation and they builded great ships to sail across the waters with food and raiment for the warriors; ships that could sail under the water and wreak destruction upon the enemy; ships that could sail in the air even as the birds fly; all manners of weapons and strangely fashioned articles of iron for the purpose of confounding the enemy were builded with much haste; and the young men with those who could not follow a trade were buckling on their armor and going out to meet the enemy.

There were some who greatly feared the battlefield and who desired to shirk the great duties before them, even though they were not useful to their home people and they flocked to the yards where the great ships were builded; their hearts were full of deceit and they opened their mouths and said "give us work that we may help our warriors," and the masters took them into the yards in great numbers, but as these numbers increased there was more confusion and much quarreling, and the masters were sore perplexed and said unto the great chief, "We are hiring more men each day, but they are not skilled artisans and we find many among them who are not content, and are even stirring up strife among the workers, and we ask that ye name a plan whereby this great evil may be remedied."

The Great Chief called his councilors together and said "Hark ye, go ye forth and make a plan so that the shipbuilders may give some of their time to the building of ships instead of quarreling with their men, and do ye name three wise men from among the people who shall make laws about the artisans' work, and all must obey these laws, particularly the shipbuilders;" and it was even so and the leaders of the artisans made a pledge that they would obey the laws made by the Three Wise Men but when they made the pledge they had their fingers crossed and they said to one another, "Yea, verily, we will do it 'in a pig's eye'."

The Three Wise Men gathered up their scribes and their retainers and journeyed for four days and nights unto the far-off city of Seattle at the edge of the woods where the roses are even as large and as sweet as cabbages, and where the wind is not all that bloweth, and they said, "Behold, Seattlites, we are here, and what is it that ye wish us to judge, and the artisans flocked to the court in great numbers, and raised such a clamor that, after ten days had been encompassed with much speech, the three wise men were loth to make a law while still within the gates of the city, and they silently departed unto the great city of San Francisco where lives the greatest tribe of shipbuilders in the nation, and a great court was established, and many councilors appeared and made much noise.

These councilors waxed eloquent and showed that many more shekels were needed because the prices of spinach had increased with great greatness, and many of the populace were moved to tears that the noble artisans could not get sufficient shekels to buy more spinach as well as the chariots which ride without the help of horses, even though their warriors were sacrificing their all for their love of the tribe only, and who could not tell their troubles to three wise men but who would be slain if they murmured against their captains.

The Three Wise Men made laws that gave more shekels, but the artisans shouted with a loud shout, "It is not enough, we must have more and still more and even though our nation needs ships we will lay down our tools unless ye come through;" and it came to pass that after much pondering, the Three Wise Men said among themselves, "Hark ye, we fear that these men are not satisfied, but we will raise our ante by ten per cent. It will perturb the harmony of the other industries but we must have peace" and it was even so.

And, as the time passed on, the great shipyards were places of constant Strife and Turmoil even as the Tower of Babel, and the only language that could be understood was 'More shekels', but the words 'More work' were even as the grass which fadeth and drieth up and behold, it is not.

The Three Wise Men pondered and cogitated and gathered many plans from all parts of the nation and they 'wotted' not 'wot' to do, but, while they were 'wotting', the artisans were clamoring, and as the days passed, and the months passed, they were still 'wotting' until their law came out with a present to the artisans for a wage back to a time when they first began to 'wot' and all was uproar and confusion and discontent.

Then it came to pass that the enemy was vanquished and great rejoicing fell upon the land, and there was much merry-making and joy that our warriors could return to us, and that we might have peace, and the shipbuilders said, "Look ye: Now that so much haste is not needed to finish our ships, we will keep only those artisans who are skilled," but a loud lamentation arose from the unskilled artisans and they beat their breasts and lifted their voices and cried "Hear ye. Our jobs will be taken by the warriors who are returning to our tribes,

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and there will be too many, and we must even make haste, and demand more shekels before it is too late;" and the artisans in the far-off city of Seattle threw down their tools; the ship artisans and even the barbers who trim the face-beards and the street-vendor who sells the nut that is called the pea, and all for the shipworker who must have more shekels than those named by the Three Wise Men.

And it came to pass that the whole city was in an uproar until the chief who is called 'Ole-For-Short" said "Hark ye, I am even chief of this city and ye must go back to your tasks, or I will provide other artisans who will take your places," and it was so and all the artisans returned to work, excepting those who were building ships and they vowed they would not work but spent their time in many meetings amid much confusion, and in a meeting there arose one who said unto them, "If ye stop the building of ships what will ye do to fill your stomachs," and they shouted with a loud shout and hooted him saying 'Go to, thou blockhead," and he went and joined another trade where the colors were not red and it was so.

Many shipyards were shut down, and much quarreling and discontent was abroad in the land, and the Three Wise Men gathered together the shipbuilders and said unto them, "We have made laws for many moons but the artisans are not content, and while we could have messed things up more than this; the time was short; we are going to depart for a far country, and after the day which is called April Fool's Day you may take up the task where we left off; our blessings upon you and may ye be as wise as we have been. Ta, Ta, when we are pitching hay on our own little farm we will think of you and your little problem."

The shipyards' masters then gathered together and said "This is a situation like that which is chronicled in the good book where it rumbles and there is much sulphurous smoke and fire, and there may be only one plan; either shut down until the nation comes to its senses or secure a few artisans that are not afraid of work, and who will be content to work under the best conditions and pay in the world."

CHEESE IT.

SIR GEORGE CAVE, the British home secretary, tells the following yarn regarding a namesake of his—Cave-Browne-Cave, who came into prominence some years ago as the 'cowboy baronet':

A certain Mr. Home, addressing one of the American Cave-Browne-Caves, casually dropped two-thirds of the name, and was promptly reprimanded with the remark:

"I say, old chap, don't call me Cave; my name is Cave-Browne-Cave."

Mr. Home apologized, but did not forget. And a little later, when Mr. Cave-Browne-Cave began a remark with, "I say, Home"—the other said:

"Don't call me Home, old chap—I prefer to be called Home-Sweet-Home."

Comparative Records of Various Types of Electric Drive for Machine Tools

An article appearing in the 'Journal' of the Engineers' Club of Philadelphia, by H. W. Tice, of the Bethlehem Steel Co., discusses service data recorded at one shop of the company at Bethlehem, Pennsylvania. The shop contained 832 motors with a total rated horse-power of 7195. The largest motors were 25 hp., used on reversing planer-drives.

Motors for auxiliary apparatus, such as drill-presses, emery-wheels, and oil-pumps for boring-mills comprised 24% of the total number with 12% of the total rated capacity. These motors were responsible for 41.5% of the total number of motor failures. In this group 89% of the machines ran at constant speed, 75% of them were equipped with direct-current motors, and the remaining 25% with alternating currents. All of the failures were for the direct-current motors, indicating that alternating current should be used on machines in this class, where the quality and quantity of the output is not dependent upon variable speed and flexibility, but upon the reliability of equipment.

The successful operation of direct-current motors depends to a large extent upon the construction of the commutator. Many commutators cannot be drawn up properly because of a misfit in the 'V' rings, allowing the oil that gets on the commutator to attack the binding material used on the mica segments. Again, overflow pipes for bearings are inadequate to take care of the overflow in case the bearings are flooded and the oil is thrown on the commutators. Flush-mica commutators will prevent many of the failures caused by the mica segments becoming carbonized.

Care should be taken in determining the position of the motor and controller relative to the other equipment in the shop in order to reduce the amount of oil, dirt, and chips that will collect on them. The common practice for the smaller sizes of motors is to place the controlling switches on the frame of the machine directly in line with the chuck and below it. This is objectionable on account of oil and chips. It is usually better to mount the controller on the left-hand side of the operator on one side of the direct line of the chuck and preferably above it. If exposure to oil and dirt cannot be avoided, the motor should be enclosed.

A comparison was made between three 36-in. reversing planer-drives, one with alternating-current belt-drive, one with direct-current and a dynamic braking arrangement, and the third with direct-current and a mechanical brake on the motor-shaft. The alternating-current motor gave the best efficiency.

A CONTRIBUTOR quotes the recent headline: 'May Use Soldiers to Poison Squirrels," and wants to know—reasonably enough—whether the objective is to be reached by having the squirrels bite the soldiers or vice versa.

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Future Aeroplane Development*

By DANA P. OGDEN

IN the fall of 1917, the common idea of many people as to both the final manufacturing of aeroplanes and the production of manufactured raw materials for aeroplane use was that an aeroplane was 'different'. If an elevator were supported by a cable having a predetermined strength, the elevator was probably all right and could safely be used to carry passengers. If the same general practice were followed in building tension members to support the loads in aeroplanes, there was considerable doubt as to whether cable made in the same way and in the same mill would prove as satisfactory in the aeroplane as in the elevator. The very appearance of an aeroplane suggested instability. So much emphasis has been placed on certain details of construction that others have been almost entirely neglected. Straight-grained and clear spruce has been painstakingly selected for certain aeroplane parts that either were not stressed at all or were so fastened into the structure that failure would occur at the fastenings long before the main body of the member was highly stressed.

Many similar examples of the same misplaced emphasis could be cited. The prime object of the aircraft industries was to produce large quantities of machines that would fly rather than to excel technically. The urgent need was for the necessary hundreds of parts that could be used forthwith, and not for a few parts that were known to be extraordinarily good. In the beginning there were few men available who had actually studied the business of making aeroplanes in quantity and fewer who really knew what was good in an aeroplane and what was not. It is natural and by no means a disgrace that the mistakes were inherited along with the good features of former practice by those who not only had to build aeroplanes quickly, but had to learn how to build them while they were doing it.

In the days when alloy-steels were scientific fads and when the only load an aeroplane had to carry was the weight of the operator, it seemed entirely reasonable that the builder of a single aeroplane would use for compression-members wood, and for tension-members a wire of some sort. Of all materials available for aeroplane spars, struts, and longerons, wood requires less machinery to manufacture and less skill to form and is the least difficult to fasten in place. However, along with its other iniquities, wood shrinks and swells and is difficult to manufacture accurately to dimension. It follows that, if a truss of exact dimensions is to be formed, tension-members must be provided that can compensate for these differences. The tension-members of an aeroplane formed with wood compression-members must be adjustable, hence a wire with a turnbuckle was used.

When it became evident that many aeroplanes would be needed for the War it was also evident that the thing to do was to proceed along known lines rather than to wait for development work, which might or might not produce a good aeroplane that could easily be manufactured in quantity.

The men available for this work knew a lot more about manufacturing than about aeroplanes and set out to manufacture aeroplanes similar to the machines with which they were familiar. Therefore the aeroplanes that have been made are frail short-lived machines, built of thousands of wood parts indifferently fastened with all sorts of fastenings, including glue, nails, screws, bolts, tape, string, metal straps, wires, and cables. Such machines are entirely unsuited to American manufacturing methods and are costly to build. Although care is used in certain of the manufacturing processes, the resulting product has the characteristics of an inefficiently manufactured machine because of its lack of ruggedness and of its short life, which characteristics are inherent in this type of construction.

Although some time may elapse before conditions are such that the enterprise seems attractive, there is little doubt that some day a cheap and efficient aeroplane can and will be made. Because of its ready adaptability to production methods, steel is the easiest and most satisfactory material to manufacture that will meet the requirements. In structural parts where lightness is essential, great strength per unit of weight can be secured by the use of alloy-steel properly heat-treated. Fastenings may consist of rivets or welds, according to the quantity to be manufactured and the strength requirements. Because of the excellent mechanical treatment given to steel in the ordinary rolling-mill and its ease of manufacture, rolled strip-steel can well be used for practically all parts. The remarkable property of ordinary cotton fabric painted with aeroplane 'dope' of both shrinking and increasing its strength in the process, will probably cause the use of this form of covering to persist for a long time, although it may be supplanted later by very thin sheets of rolled aluminum alloy or other similar metals.

It is probable that the future of the aeroplane motor will be governed by the advances that are made in automobile-motor design and construction. It seems unnecessary to assume that, although the present aeroplane motors are fairly satisfactory, the art will not progress as rapidly in the future as it has in the past. Certainly

*Abstract from 'The Wisconsin Engineer'.

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an efficient propeller should be produced in the near future. It is difficult to imagine why, if the proper precautions were taken, a steel propeller could not be built that would prove satisfactory. Most of the previously attempted metal propellers have not been built of the most suitable grade of steel or given the proper heat treatment. It is entirely unfair to confound a metal propeller made of ordinary commercial mild steel and fastened with rivets with the best that can be done by using a chrome-nickel-vanadium steel properly forged and heat-treated.

The most striking difference between the present and the future aeroplane will probably be the matter of simplicity of design. It is possible to manufacture from strip-steel, by simple rolling, die-drawing, and continuous-welding operations, tubes, channels, stream-line, and other structural shapes that can be built into a simple aeroplane which would compare favorably with the best wooden machine thus far made. Furthermore these steel shapes can be stressed either in tension, compression, or bending. This alone would eliminate practically one-half of the important structural parts that are now used. That is, there would be no distinct flying or landing members. Ribs, aileron-horns, and control-parts could be stamped from one piece instead of being built up as at the present time. Because steel parts can be accurately made to dimensions it would be unnecessary to use adjustable members to secure rigidity. Such adjustable members as were used could be reduced to the minimum.

Perhaps the greatest obstacle to such a manufacturing scheme is the apathy of many of the directors of manufacturing industries concerning proper heat-treatment of steel parts. In general, for all forming, stamping, drawing, and welding, steel should be properly annealed before the operation to render the manufacture possible. In order to secure great strength in alloy-steels it is necessary that the last manufacturing operation should be a hardening and toughening heat-treatment effected by raising the steel to a temperature just above the upper temperature of its critical range (1400–1700°F. for most ordinary steels except those containing tungsten) and cooling rapidly by immersing the part to be treated in oil or water. To secure ductility and resistance to shock the parts should be tempered by being re-heated to a lower temperature than at first. It is entirely absurd to carry out all of the manufacturing operations properly except the heat-treatment and to expect the finished article to be a good job.

After Patsy Hogan had left Dublin for the country he purchased a monkey. Afterward he explained:

" 'Twas like this: I chained the monkey in me yard, and the coal trains were passin' all day, and on iv'ry thrain there was a stoker. In one week I had two tons of coal in me cellar, and the monkey was never wanst hit!"

Rules for Repairing Boilers by Autogenous Welding

The British Board of Trade has published for official use the following instructions to surveyors of vessels on the subject of making repairs to the boilers of passenger-steamers by the electric or oxy-acetylene processes:

"The repairing of the boilers of passenger-steamers by the above processes has been tentatively in operation for a considerable period and, in view of the experience gained, the surveyors are informed that, provided the work is carried out to their satisfaction by experienced workmen, these processes may be employed, within limits, for repairing cracks in furnaces, combustion-chambers, and end-plates of boilers, and in the same parts for reinforcing the landing-edges of leaky riveted seams that have become reduced by repeated chipping and calking.

"In some old furnaces that have been repaired by the above processes it has been found that, after a few months' working, cracks have again developed at parts adjacent to those welded; probably owing to the original material of the furnace having become fatigued and worn out by long and severe usage. In dealing with old furnaces, therefore, this fact should be considered.

"It has also been brought to the notice of the board of trade that a shell-plate of a cylindrical marine-boiler cracked recently through a solid part where some surface-welding had been done by the electrical process two years ago. The welding had extended for a length of about 12 in. along the outside calking-edge of one of the middle circumferential seams at the bottom of the boiler, the leaky edge of the seam and the adjoining shell-plate having been covered (soldered) by metal deposited by this process in the usual way. The shell-plate was 1-5/32 in. thick, and the crack, which followed the line of surface-welding, extended for a distance of 2 ft. 9 in., the welded part being situated midway along the crack.

"For the present it is not proposed to prohibit, within limits, the reinforcement of the circumferential seams of boiler-shells if the end-plates are well stayed but no welding should be done to these parts by any process that may cause local heating over an appreciable area of the plate, such as oxy-acetylene or similar methods.

"In no circumstance should any part of a boiler of a passenger-vessel be welded if wholly in tension under working conditions, such as a stay or the shell-plate at a longitudinal seam, the failure of which, by cracking at the welded part, might lead to disastrous results.

"In any case in which the proposed repairs to the boilers of passenger-vessels by either of the above processes are of an uncommon or unusually extensive character, the particulars should be submitted to the board.

"After repairs by welding have been completed, the parts at or adjacent to the welds should in all cases be well hammer-tested; and, unless the welding is of a trifling character, a hydraulic test of not less than one and a half times the working pressure should be applied to the boiler after the hammer-testing has been effected."

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Bolts and Spikes From Scrap

By LETSON BALLIET

During the War I was employed at one of the shipyards as an efficiency engineer. While so engaged, my mining experience proved of great benefit in several ways. Incidentally the adaption of a mining tool to ship-building work carried the development further, which I think might be profitably used in many shops.

One particular installation and its subsequent development is of interest. I had installed a Sullivan drill-sharpener with which to make bolts. The idea was not wholly new nor original with me, though I designed and made special dies and dollies for special shaped heads needed. Drift-pins were headed, countersunk heads of various sizes and the like were made in large numbers. Then we made ball stanchions, grab-iron ends, rivet dies, and numerous other things that required upsetting; in fact, the drill-sharpener became an upsetting machine of great possibilities.

Heading long rods quickly in three seconds dispensed with the necessity of threading two ends of a rod, and using two nuts. Upsetting the end of a rod to a ball, and then flattening it under the vertical hammer, and punching a hole in the flattened part, did away with drawing a rod out and welding it into an eye-bolt. In some cases this dispensed with expensive turnbuckles. All of these features will have more or less use in building of head-frames, the framework for mill buildings, and possibly in making one side of hanging-bolts, to avoid the upward pointing hook for safety. What appears to me to be of greatest value for a shop is the making of the track-spikes and track-bolts out of the scrap-pile.

Few shops can be found that do not have a lot of old bolts, hanging-rods, and scrap rod-iron lying around. This may be run through the drill-sharpener and made into spikes of any size. They make a better, stronger, and more perfectly formed spike than any that can be bought; they are all uniform because they are in effect a drop-forge spike, and all come from the same die; they can be made by the blacksmith helper or any common laborer because they do not require tempering. A heater boy, who heats rivets, can lay them with the tongs in the die, and throw the lever that operates the machine—the machine does the rest. A perfect spike is made in about three seconds from the scrap now wasted. The machine can be so used when it is not engaged in sharpening drills, and it will make easily from 3000 to 4000 spikes in eight hours.

The question arises, why pay from $8 to $10 per 100 lb. for 300 or 400 spikes (depending on size) when a man or boy at 50 cents per hour can make them from the scrap-pile in an hour? Any old bolt 3 or 4 in. long will make a track-spike. More than this, the same machine with a change of die, will make all the track-bolts from the same scrap or will make a new bolt out of an old one. The neck and head of every bolt is perfect in size and shape. Naturally they come from the machine without threads, but the threading die can be chucked in a small lathe or drill-press, and a head-holding tool made for the lathe or press. Thus a track-bolt or any other bolt that is costing from $7 to $15 per 100 lb. (depending on size) can be made and threaded for $1 or $1.50. Even the nuts are hot forged from bits of scrap in three seconds time, and the hole punched. They must be tapped, but by using an extension chuck fastened in the lathe, or in a wood-boring machine fastened to a work bench, we tapped them at the rate of 720 per hour.

There is not a shop that has an air-compressor that needs buy a single track-spike, track-bolt, lag-screw, or

The above shows a lag-screw made from a burnt rivet from the scrap-pile, and a ⅞ by 5-in. bolt made from another rivet. In the centre are two ¾ by 2-in. bolts made from two bent bolts with stripped threads. On the bottom line is the end of a headed drift-bolt which is 1 by 32 in., and ⅞-in. nut made from a punching from boiler-plate. The nut is partly or imperfectly finished on the outside to retain enough of its rounded corners to show what it originally was.

any other bolt where the quantity used of one size would justify the making of the die. All bolts of the same diameter, whether of 2 or 8 in. length are made in the same die.

Heading-rods and drift-bolts of the same diameter rod is done in the same die regardless of length. These ideas are free to all that care to use them.

A glass of soda underneath the bough,
A slug of fudge, a Rollo book and Thou
Knitting beside me in the wilderness;
Oh, wilderness were prohibish enow.

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Solder, Soldering Flux, and Soldering*

By F. A. KARTAK

SOLDERING is the process of uniting two pieces of metal with a third soft metal which is applied in a molten state. The metals to be united may be either the same or dissimilar, but the solder must be such as will alloy with both at the soldering temperature.

Two conditions must be fulfilled in all soldering work:

1. The surfaces to be united must be bright, smooth, and chemically clean.

2. Contact of air with the surfaces to be soldered must be excluded during the process, since this is likely to oxidize the surfaces as the soldering temperature.

These conditions are partly fulfilled by a mechanical cleaning of the surfaces, by filing, scraping, scouring, or grinding, and further by the use of a so-called flux, which may assist in the cleaning as well as in preventing oxidation by excluding the air.

Both the compositions of the solders and of the fluxes used depend upon the natures of the metals to be joined. Solders may in general be classified as hard solders and soft solders, typical examples of which are given in Table I.

The hard solders melt only at the higher temperatures and are usually employed for fine work where considerable mechanical strength of joint is required or where a joint of better electrical characteristics as for fine instrument work is desired. The soft solders (or tin solders), which are those employed in the majority of soldering processes, are used principally because of the lower soldering temperature permitted, this temperature rarely exceeding 400°F. At the lower temperatures it is not so difficult to prevent oxidation of the surfaces to be soldered, nor to prevent the burning of insulation or other materials in the vicinity of the joint.

The proper flux to be used will depend to a considerable extent upon the nature and material of the surfaces to be joined. A flux may act in one or more of the following manners:

1. As a means of covering the brightened metal surfaces to exclude air.

2. As a solvent for the metal oxides formed by the action of the air.

3. As a coagulant or detergent, cleansing and floating from the metal surfaces the oxides and other foreign matter present.

Rosin (or colophony) can be used alone only where the surfaces are bright and clean. When heated in the process of soldering, it flows over the joint, excluding air and floating away the excess foreign matter. Its principal use is in soldering iron covered with a coating of tin, where it is essential that a flux be used that will not, under any circumstances, eat through the tin coating. Rosin may be used only for soft soldering since it chars at the higher temperatures.

*Abstract from 'The Wisconsin Engineer'.

TABLE I.*

No.	Name of Solder	Composition in Parts	Flux	Melting Point
1	Lead solder, coarse	Tin, 1; lead, 3	Rosin	797° F.
2	Lead solder, ordinary	Tin, 1; lead, 2	Rosin	439° F.
3	Lead solder, particularly good	Tin, 1; lead, 1	Rosin	388° F.
4	Tin solder	Tin, 1.5; lead, 1	Rosin, or zinc chlor. solution	334° F.
5	Tin solder, particularly good	Tin, 2; lead, 1	Rosin, or zinc chlor. solution	340° F.
6	Hard solder for copper, brass, iron	Copper, 2; zinc, 1	Borax	
7	Hard solder for copper	Malleable brass, 5; zinc, 1	Borax	
8	Hard solder for copper, readily fusible	Copper, 1; zinc, 1	Borax	
9	Hard solder for copper	Hammered sheet-brass	Borax	
10	Silver solder for gold-workers	Silver, 19; copper, 1; brass, 1	Borax	above
11	Silver solder for sheet	Silver, 2; brass, 1	Borax	797° F.
12	Silver solder for silver, copper, iron	Silver, 1; brass, 1	Borax	
13	Silver solder for steel	Silver, 19; copper, 1, brass, 1	Borax	
14	Silver solder readily fusible	Silver, 5; brass, 5; zinc, 5	Borax	
15	Gold solder	Gold, 12; silver, 2; copper, 4	Borax	
16	Bismuth solder	Lead, 4; tin, 4; bismuth, 1	Rosin, or zinc chlor. solution	320° F.
17	Bismuth solder	Lead, 3; tin, 3; bismuth, 1	Rosin, or zinc chlor. solution	311° F.
18	Bismuth solder	Lead, 2; tin, 1; bismuth, 1	Rosin, or zinc chlor. solution	291° F.
19	Bismuth solder	Lead, 2; tin, 1; bismuth, 2	Rosin, or zinc chlor. solution	232° F.
20	Bismuth solder	Lead, 3; tin, 5; bismuth, 3	Rosin, or zinc chlor. solution	201° F.
21	Tin solder	Lead, 4; tin, 3; bismuth, 1	Rosin, or zinc chlor. solution	----------

*Brant, Metal Alloys.

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The active constituents of the most commonly used fluxes may be classified as shown in Table II.

Table II

Principal Constituents of Soldering Fluxes

Name of material	Principal fluxing action	Principal use
Rosin (colophony)	Detergent	Tinned iron, copper, brass
Zinc chloride	Oxide solvent	Copper, brass, tin, iron
Ammonia	Reducing agent	Brass
Ammonium chloride	Oxide solvent	Copper, brass, tin, iron
Hydrochloric acid	Formation of zinc chloride	Zinc, galvanized iron
Ammonium phosphate	Oxide solvent	Zinc, tin, copper, brass
Lactic acid or ammonium lactate	Oxide solvent	Zinc, copper, brass
Phosphoric acid	Oxide solvent	Copper, brass, bronze
Borax or boric acid	Oxide solvent	Copper, brass, silver, gold
Powdered glass, or sand	Oxide solvent	Iron

Zinc chloride, which forms the active constituent of practically all ordinary soldering fluxes, acts as a solvent for the metal oxides. It should contain no free acid and is often neutralized by the use of ammonia. This is, however, a somewhat questionable procedure, since any free hydrochloric acid in the zinc chloride will react to form ammonium chloride, which may have a corrosive effect if not carefully washed from the finished joint. For this reason, when zinc or ammonium chlorides are used as fluxes, the finished joints should be washed to remove any excess of the chlorides, since both of them are corrosive, especially in fine soldering work.

Ammonium chloride, as pointed out above, acts similarly to zinc chloride but is a stronger corrosive agent.

Lactic acid or ammonium lactate has been found satisfactory for soldering zinc, copper, and brass. It is particularly useful for soldering small zinc parts where zinc chloride is not satisfactory because of its peculiar action on zinc. When lactic acid or ammonium lactate are used on copper or brass, they will become tarnished in a few hours, because of the reaction with copper oxide that takes place at ordinary temperatures.

Ammonium phosphate in aqueous solution may be used on zinc, tin, copper, and brass, but not on iron. When used in place of lactic acid, it will not tarnish copper or brass.

Hydrochloric acid is used in the soldering of galvanized iron or large zinc parts, where it reacts with the zinc to form zinc chloride. To prevent future corrosion, great care must be taken to wash away the excess acid upon the completion of the joint.

Borax and boric acid are generally used as fluxes for hard soldering at high temperature. The dry crystals of borax fuse and form a glass-like coating with the oxides, which are dissolved by virtue of the boric acid present.

Glass or sand, finely powdered, is often used in hard soldering, the oxides being dissolved by virtue of the silicic acid present.

Phosphoric acid, in a solution of alcohol, has been successfully used as a flux, the acid dissolving the metal oxides.

Ammonia, when used on brass, acts as a flux by reducing the oxides.

In commercial work, with some few exceptions, it is usual to find fluxing compounds containing one or more of the above constituents. These compounds may take the form of liquids, fats, or pastes, or solid sticks or powders. The so-called soldering fluids for ordinary work usually consist of a solution of zinc or ammonium chlorides to which has been added alcohol and glycerine in about the following proportions:

Saturated solution of zinc chloride	5 parts
Alcohol	4 parts
Glycerine	1 part

The alcohol aids in the cleansing of the metal surfaces and the glycerine helps to give fluidity to the solution and adhesion to the joint when applied.

A similar flux is as follows:

Zinc chloride (neutral)	27 parts
Ammonium chloride	11 parts
Water	62 parts

Mueller's soldering fluid consists of

Phosphoric acid solution	1 part
80% alcohol	1 part

For soldering tinned iron, when it is not desirable to apply the rosin in powdered form, the rosin may be dissolved in alcohol, benzine, turpentine, or sweet oil. If the last solvent is used, the disagreeable odor of benzine is avoided and the solvent does not evaporate on exposure to air. The benzine and alcohol, however, aid in cleansing the metal surfaces.

For the soldering of cooking utensils and the like, where the gummy residue left by the rosin-flux after soldering is objectionable, soldering-fats are often used, whose residues are greasy and may easily by wiped off. The soldering fats consist generally of a base of rosin, tallow, and olive oil to which has been added a small quantity of sal ammoniac or zinc chloride. Good proportions are as follows:

For soldering tin plate, melt together 150 parts beef tallow, 250 parts rosin, and 150 parts olive oil. Add 50 parts of sal ammoniac dissolved in as little water as possible. To give this a pasty consistence, reduce the amount of rosin.

The so-called acid-free pastes to be found on the market are probably nothing more than the above compound with slight variations in proportions. Very often a vaseline base is used. Even though they are advertised as 'acid-free' they should be viewed with suspicion, since the sal ammoniac may have a corrosive action if allowed to remain on the completed joint. For soldering iron, 50 parts olive oil and 50 parts powdered sal ammoniac may be used. For soldering aluminum, melt together 50 parts rosin and 50 parts tallow, and add 25 parts zinc chloride.

Soldering sticks are much the same as soldering fats or pastes with the addition of sufficient rosin to permit the compound being cast into sticks upon cooling. The disadvantage of using a stick in soldering is that the flux must be applied by melting it upon the heated metal of the joint to be made, thus encouraging oxidation before the flux can take action.

Rosin in powdered form may be applied directly to a tinned-iron joint in soft soldering. The so-called commercial soldering salts are probably nothing more than powdered rosin and zinc or ammonium chlorides together with some base material. Borax used in hard

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soldering is usually applied in a dry or powdered state. Powdered glass or sand used in soldering iron at a red heat is applied in a dry state.

After properly cleaning and clamping or holding together the metal surfaces to be joined and applying the flux, the joint may be heated either by the direct application of a soldering 'copper' or 'iron', that has been previously heated. The use of the 'copper' is advisable where there is danger of igniting other materials by the flame of the torch.

Whenever possible in soft soldering, additional mechanical strength should be given the joint by clamping, such as the use of a twisted-wire joint or a clamped seam in sheet-metal, the solder serving principally as a locking or sealing medium. In hard soldering or brazing work, the solder is mechanically strong enough to withstand such strains as the metals may be subjected to.

In using soldering 'coppers', the life of the copper is greatly shortened if it is allowed to overheat in the flame of the blow-torch or in the furnace, causing excessive oxidation and consequent scaling. If it is badly overheated, it may be necessary to file off the oxide and smooth the point after which the point or tip should be re-tinned. This is accomplished by heating the copper to its proper temperature, and coating with solder, either by rubbing it on the solder after cleaning by contact with soldering flux, or preferably with ammonium chloride.

In hard soldering it is preferable to clamp the two edges or metal parts in proper relationship, place the borax-flux upon the joint, heat with a blow-pipe or torch, and when the joint is sufficiently hot, apply the solder.

The spreading of solder upon a brass or copper surface may be prevented by painting the surface around the soldering-zone with a weak solution of water-glass, over which the solder will not flow.

For removing enamel insulation from magnet-wire previous to soldering, burn the insulation from the wire at the desired point and then clean the copper surface with nitric acid. The excess acid should be carefully washed off before using flux and solder.

In soldering cables or wires into lugs it is first necessary to tin the recess in the lug by heating and applying flux and solder. The end of the cable or wire should be similarly tinned. By applying heat to the lug and partly filling it with solder, the process may be completed by plugging the tinned cable-end into the lug and cooling it while holding it in position. Only enough solder should be placed in the lug to fill the space around the wire or cable completely. If more is used, it will overflow and adhere to the outside of the lug unless this be first covered with a coating of light oil of high flash-point.

The soldering of aluminum has always been attended with difficulty for the reason that metallic aluminum oxidizes almost instantly upon exposure to air. The difficulty has, therefore, been to obtain a satisfactory metallic contact between the solder and the aluminum. A satisfactory manner of soldering is by first cleaning the aluminum surfaces thoroughly of grease and dirt with benzine. The following solder is then applied with a 'copper':

Block tin	28	parts
Phosphor tin (10% phosphorus)	14	parts
Lead	3½	parts
Spelter	7	parts

After the molten solder has covered the surface, it should be scratched through with a wire brush to break the oxide on the metal surface. Quick manipulation is necessary.

The soldering of cast-iron is a difficult process because it is hard to obtain a uniformly adhering soldering-surface. A smooth cast-iron surface contains numerous small particles of carbon which interfere with a satisfactory joint. To clean cast-iron surfaces for soldering, especially in corners or openings which it is difficult to scrape or brighten mechanically, a thorough acid pickling followed by a lavish treatment with strong soapsuds will be found satisfactory in many cases.

ONION CONQUEROR

A NEW YORKER has just brought this story from a prohibition district of the South. A native colonel had received by express a bottle of whisky. Sampling it, he found its quality such that even in a dry State a white man couldn't drink it. He sent for one of his faithful negro retainers and made him a present of the bottle. Thereafter, meeting the recipient of the gift he asked him how the whisky had suited him.

"Suited me 'zactly, kunnel," replied the colored man. "That whisky was shorely jus' right foh me. Any better, you'd a drunk it, en any wusser, nobody could drink it."

THE story is going around of a man who spent 50 cents for advice on 'What to Do at the Table', and the reply came back on a postcard, "Eat".

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Application of the Sand-Blast to General Foundry Work—Part I

By H. D. GATES*

THIS is the first of two articles by Mr. Gates on sand-blast equipment. It discusses the general question of cleaning castings by the sand-blast and describes the various types of hose machines. Part II, which will appear in the May issue, will describe the design and use of other types of sand-blast machine, such as the barrel, cabinet, and table types.

PROBABLY no single operation in foundry practice has shown as much advance in the past decade as the cleaning of castings. Formerly, brushing, tumbling, and rubbing were the only means generally used. Ten years ago, although a few foundries had installed a sand-blast, such an outfit usually comprised merely a machine set in the open or in some isolated place, and the conditions surrounding its use made it a detested device, although its efficiency even under these adverse conditions was readily recognized. However, progressive foundries have concluded that the investment necessary to provide suitable working conditions gives as large or larger returns than any other foundry equipment of equal cost, until today no foundry is considered completely equipped without sand-blast outfit that is adapted to its particular work and conditions.

Where the daily output is of a varied character and the tonnage is sufficient to warrant, the greatest economy will be found in the selection of a separate unit for each class of work, and designed to handle it with greatest rapidity at lowest labor cost, the whole outfit arranged in accordance with the routing and handling system of the plant. For the average jobbing foundry, however, where the work ranges from small to large, and the daily output is not large enough to permit of such specialized equipment, no type of machine is better adapted than the high-pressure hose sand-blast. When this is rightly installed in a properly designed room, working conditions are obtained that greatly reduce the occupational hazard, and provide a valuable and profitable cleaning equipment.

The hose-type machine was the first method of sand-blasting to be developed. It consists of a sealed container into which the sand or other abrasive is loaded, driven by direct air-pressure through a hose of required length, the air and abrasive being discharged in combination through the opening of a small nozzle. Compressed air at the hose-line pressure is introduced into the top of the sand-chamber, equalizing the pressure so that the abrasive is fed by gravity through a small adjustable valve opening into a mixing-chamber at the bottom of the container, where it is combined with and picked up by the air-flow. As no expansion of the air takes place before discharge at the nozzle, the greatest velocity of the abrasive is obtained by this method, with corresponding effectiveness of abrading action.

Another type of hose machine is called the 'open hopper', in which the container is not sealed, the abrasive being carried to the nozzle by suction. The combination of abrasive and air takes place in a chamber where some expansion of the air occurs together with a drop in pressure, therefore, while this type of machine is admirable for many classes of work, its abrasive efficiency is hardly adapted to general foundry requirements, and machines

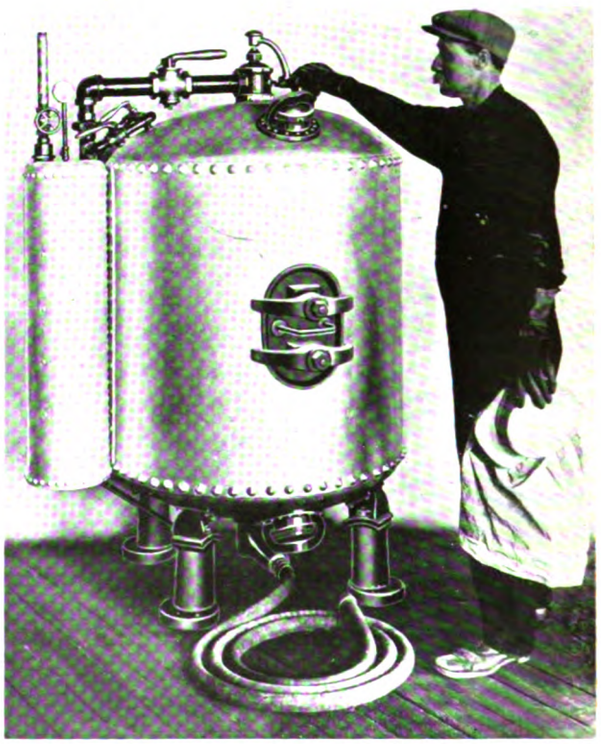

FIG. 1. STANDARD HOSE-TYPE SAND-BLAST MACHINE

*Pangborn Corporation, Hagerstown, Maryland.

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of this type will not be considered since they are not included in the scope of these articles.

The first hose machines offered were of the low-pressure type, using from 15 to 30 lb. pressure, with large hose and nozzle, and depending on volume of sand at low velocity for the cleaning action. This meant that the standard shop-pressure of approximately 80 lb. either had to be reduced or else a separate low-pressure compressor provided for the sand-blast machine.

This double compressor-equipment involved not only increased investment but also the additional cost of piping and installation, with necessary added care and attention. Initially compressing the air to the higher pressure at the greater cost and then reducing to the lower pressure was a waste of energy with consequent expense, and as developed later, gave a decreased blasting efficiency. In addition, there was the increased amount of dust caused by the greater volume of sand flowing, to the detriment of both the operator and the rest of the plant. To obviate these drawbacks the modern high-pressure sand-blast was developed ten or fifteen years ago. This is now recognized as the standard for general foundry use. See Fig. 1.

The velocity of the abrasive after leaving the nozzle increases rapidly as the air-pressure is increased, with correspondingly greater blasting effectiveness. This permits the use of a small easily handled hose and nozzle, in place of the large cumbersome hose and nozzle used with the low-pressure machine, with a decided saving in labor in proportion to the tonnage cleaned. Better operating conditions were also obtained through reduction of dust created by disintegration from the lesser volume of sand used. This will become evident from a study of the results of tests made. These showed that the amount of sand blown at 30 lb. pressure to remove one pound of metal from an iron bar was 3361 lb., while at 70 lb. pressure the required sand was only 2043 lb. or 40% less at the higher pressure, the same size nozzles being used in both instances. As for re-usable sand, the low pressure gave only 17.2% more than the higher. The amount of metal removed per 100 cu. ft. free air flowing per minute was, at 30 lb. pressure, 0.1969 cu. in., and at 70 lb., 0.4473 cu. in. or nearly two and one-half times as much accomplished at the higher pressure with no increase in time and labor.

The amount of air consumed in sand-blast operation is governed entirely by the size of the nozzle-opening and the pressure maintained. This feature is therefore one that should have the most careful consideration of the prospective sand-blast user. Constant wear, varying with pressure and abrasive, is occasioned in the opening of the nozzle and a little enlargement means considerable increase of air consumed and horse-power as well. For instance a nozzle with $\frac{1}{4}$ in. opening delivers 76 cu. ft. of free air per minute at 70 lb. pressure (as in the sand tests above) requiring 12.7 horse-power to develop. Increase this opening $\frac{1}{32}$ in. and the air-flow increases to 85.5 cu. ft. or 12.5% and the horse-power requirement is 14.3. An enlargement of $\frac{1}{16}$ in. increases the air-flow to 118 cu. ft. or 16.5% more, with horse-power developed 19.9. If the increase is $\frac{1}{8}$ in. the air-flow jumps to 171 cu. ft. or a total increase of 125% while the horse-power developed rises to 28.6. If this wear and consequent enlargement of orifice can be eliminated much power expense can be saved as well as constant pressure maintained.

Different types of nozzles are illustrated in Fig. 2, showing the discharge-end view, No. 1 being of a new nozzle with a $\frac{1}{4}$ in. opening, No. 2 the same nozzle when worn to the point of discarding. Note that the worn nozzle has still retained the inlet-opening size with no increase of air consumption. No. 3 shows another type of nozzle with natural increase of size causing increased air-flow and increased power consumption.

While it must be admitted as a general statement that the larger the nozzle opening the greater the area of work cleaned, still the owner of the average plant wants the air consumption pre-determined. In many instances where the air volume is limited, any increased consumption means a drop in pressure not only at the sand-blast

FIG. 2. DIFFERENT TYPES OF NOZZLES

but also throughout the entire system, often to the detriment of other air-tools.

The hose-type sand-blast must, of course, be operated in a dust-tight enclosure. While a room of this character can be 'home-made', the greatest economy will come from a substantial room designed and built to provide adequate ventilation and illumination and arranged as to handling methods for the greatest saving in time and labor. As the abrasive will be used again and again and a certain amount of dust is produced with each operation, not only working conditions, but also the efficiency of the abrasive itself require a thorough cleaning each time before re-use in order to secure greatest output with corresponding economy.

For the simple rooms where the sand-blast machine is placed inside the room, an abrasive separator equipped with a powerful air-motor with double screens is provided. The spent abrasive is shoveled into the separator from the floor. Three separations are made in one operation, the fine material that has no abrasive value and the coarse material that would clog and stop the nozzle being separated, while the clean sharp abrasive for re-use is delivered to a hopper for re-loading the sand-blast machine. See Fig. 3. The more mechanical the handling of the abrasive, the more continuous the operation of the

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sand-blast machine with correspondingly increased output and lower cleaning cost per ton.

The modern sand-blast room is built of sheet steel made dust-tight, with fresh-air inlets around the sides near the base, the dust-laden air being removed by powerful exhaust-fan through a hood in the ceiling of the room. The volume of dust created will vary with the character of work cleaned, that is, whether plain surfaces to which little sand adheres, or intricately shaped pieces from

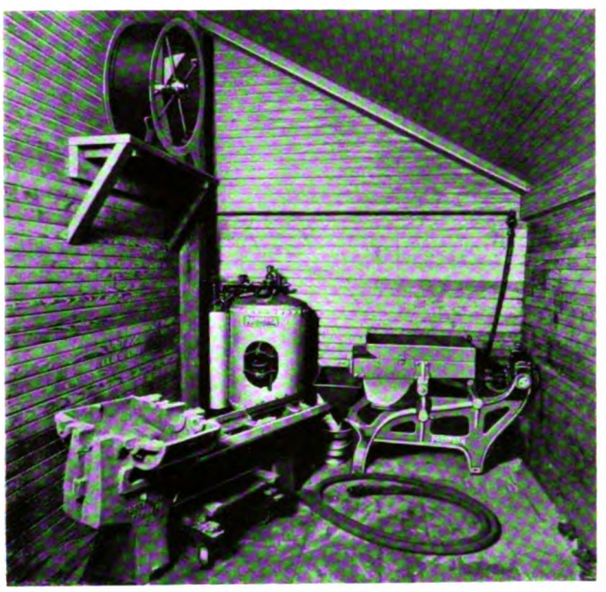

FIG. 3. SEPARATING-EQUIPMENT

which cores must be blasted; also whether sand or metal abrasive is used, and, if sand is used, its friability.

The air in the room should be changed from five to ten times per minute according to the work. The natural tendency of the dust is to rise, and this is aided by placing the intake of the air at the base of the room and drawing it off through the ceiling. Some provision must be made for the protection of the operator, as the dust-laden air will be present no matter how rapid the circulation. Various types of hoods and helmets have been devised, the ventilated dust-proof type being the most effective.

The helmet fits closely to the head and is tied tightly around the neck, fresh air being introduced constantly by means of a small flexible rubber hose connected to the compressed-air line. This hose is long enough to permit freedom of movement by the operator and being weighted over a pulley, the slack is constantly taken up without enough weight to become burdensome. Through a series of minute openings in the adjustable sweatband, at the front of the helmet, a constant jet of air passes before the operator's nose and mouth, which prevents the screen-glass from becoming fogged or misty, thus assuring free vision.

Electric-light fixtures should be provided, with white enameled reflectors, set into the ceiling of the room and covered with discoloid fronts to protect the lamps from flying abrasive. Ventilation and free observation of the work being essential to quantity production, these features should not be slighted.

The sand-blast room can be equipped as the demands of the plant and its output require. Large heavy castings should be loaded at the molding floor on grated-top cars, the track extending into the sand-blast room, and the pieces can be cleaned on the car without unloading. If the plant is equipped with a monorail, this too can be extended into the room and the pieces cleaned while hanging and without other handling. For small work a grated-top bench can be provided where convenient, and for very small pieces much economy will be found in cleaning on the gates, this method having the advantage of saving tools and giving, without extra time and cost, clean scrap. This is particularly advantageous and even necessary in the use of some types of electric furnace.

One of the more modern adjuncts to sand-blast rooms is the rotative table, which is built into, but entirely independent of the room structure. Half of the table forms a grated bench on the inside of the room, while the other half is exposed outside the room for the removal of the cleaned work and loading of new work to be cleaned. A partition through the centre of the table entirely closes the aperture in the wall-structure when the table is in position for sand-blasting. As a load is cleaned the operator turns the table, which travels on dust-proof ball-bearings.

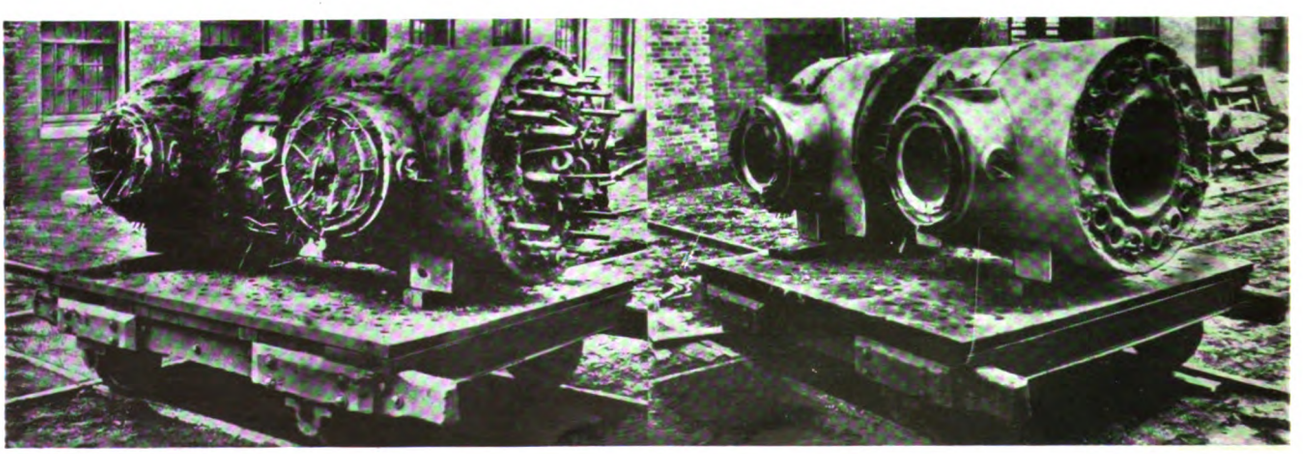

FIG. 4. GAS-ENGINE CYLINDER BEFORE AND AFTER CLEANING

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Some rooms having a solid floor are provided with a chute in one wall leading to an elevator-boot, into which the spent abrasive is swept or shoveled, being raised by a mechanical elevator to a combined mechanical and exhaust-screen separator that delivers the clean sharp abrasive for re-use to a sand-storage bin connected to the sand-blast machine. The fine dust and refuse is deposited in a refuse-bin with outlet at a convenient point.

When this type of equipment is used the sand-blast machine is usually placed outside, leaving the room entirely free from operating equipment. The controls for the operation of the sand-blast machine and for the elevation and re-loading of the abrasive are brought to a single control-board within convenient reach of the operator.

A step further in the direction of mechanical handling is a grated floor for the room through which the spent abrasive falls to a hopper, from which a conveyor delivers it to the elevator. Rooms of this type are usually made complete with a hopper of concrete. Provision is also made for an auxiliary sand-storage bin, loaded from the outside with several days supply of abrasive, which is fed to the system as required through a sand-gate.

The large gray-iron gas-engine cylinder shown in Fig. 4 weighs more than five tons and required the labor of two men for 15 hours, or a total of 30 hours, for cleaning by hand. Including cores it was cleaned with a modern high-pressure sand-blast by one man in an hour.

The demand for hygienic rooms that entirely remove the operator from the sand-blast enclosure has developed devices of different types, which meet every requirement. Such rooms are provided with a sight-screen on four sides through which the operator may see his work. Below this is a nozzle slot or opening, closed by sectional flexible curtains, through which the operator directs the nozzle on the work to be cleaned. While this permits the operator to work in the open and without other protection than that afforded by the room, ventilation is necessary for the removal of the dust so as not to obstruct illumination and free observation of the work.

Rooms of this kind are better adapted to work of fairly uniform size, as the width and length of the room should be such as to bring the work reasonably close to the nozzle-slot on all sides and to keep ventilation requirements at the minimum. These rooms are particularly suited to large and heavily cored work and for cleaning long lathe-beds and other work of this nature. For such work they are usually constructed long enough to receive a little more than half the longest piece, with the other half extending through the curtains closing one end of the room, the pieces being reversed for cleaning the other half. In this way pieces 20 to 30 ft. long are readily cleaned in a room a little more than half that length.

(To be Concluded in the May Issue)

A matter that's worthy of note
Is the pearls that the oyster doth tote;
He wears 'em—how rummy—
About on his tummy.
For he hasn't a beautiful throat.

Lighting of Warehouses and Loading-Platforms

A recent issue of the 'Journal' of the Engineers' Club of Philadelphia cnotains an article by A. L. Powell and R. E. Harrington, which, while mainly devoted to lighting of piers and freight-depots, discusses also warehouses and loading-platforms. In most instances lamps should be hung as high as possible. If this is done with judgment, the average intensity of illumination is not reduced. Lamps near the ceiling are not so likely to become broken and reflectors do not become so dirty as when the lamps are placed lower. All lamps should be provided with reflectors, both to protect the eyes and to direct the light where it is most needed. A given area can be lighted adequately with 25 to 50% less power if the lamps have reflectors than if they are bare. Steel reflectors are preferable to glass, on account of the danger of breakage. These should be finished with white porcelain enamel.

In general, large lamps are more efficient and cost less per unit of illumination than small ones. In addition, the cost of wiring and maintenance varies with the number of outlets. There are, of course, practical limits to be considered. For instance, assume an area of 4000 sq. ft. to be lighted with an intensity of 0.25 watt per square foot. This will require 1000 watts, but a single 1000-watt lamp would not be suitable, provided the ceiling is of ordinary height. In warehouse the intensity of illumination should be greatest near the doors and along the main aisles. An average illumination of 0.15 to 0.25 watt per square foot is recommended. In general, the maximum spacing, centre to centre, of units is as follows: Ceiling, 10 ft. or less, 16 ft.; 10 to 15 ft., 20 ft.; 15 ft. or more, 30 feet.

For long rooms less than 30 ft. or one bay wide, one central row of outlets is preferred. If the room is wider, the outlets should be spaced symmetrically in the bays.

Similar rules as to units and spacing apply to loading-platforms. To provide for lighting cars that are to be loaded or unloaded, socket-receptacles should be placed on pillars near the track side. Extension-cords with suitable sockets and lamps with wire guards should be used inside the cars.

In all cases a liberal use of light-colored paint on walls, ceiling, and other parts of the structure will help to solve the lighting problem. Another general rule, and one that is frequently neglected, is that all parts of the lighting system should be carefully maintained, lamps renewed, and lamps and reflectors kept clean.

THE colored elevator-girl looked at the service-pin.

"Is yo' husband in France, lady? she inquired.

Passenger (blushing furiously): "No. This is for my sweetheart over there."

"Tee-hee! O Lawdy! If I wore a star fo' every beau I had in France, I'd look like de Star-Spangled Banner."

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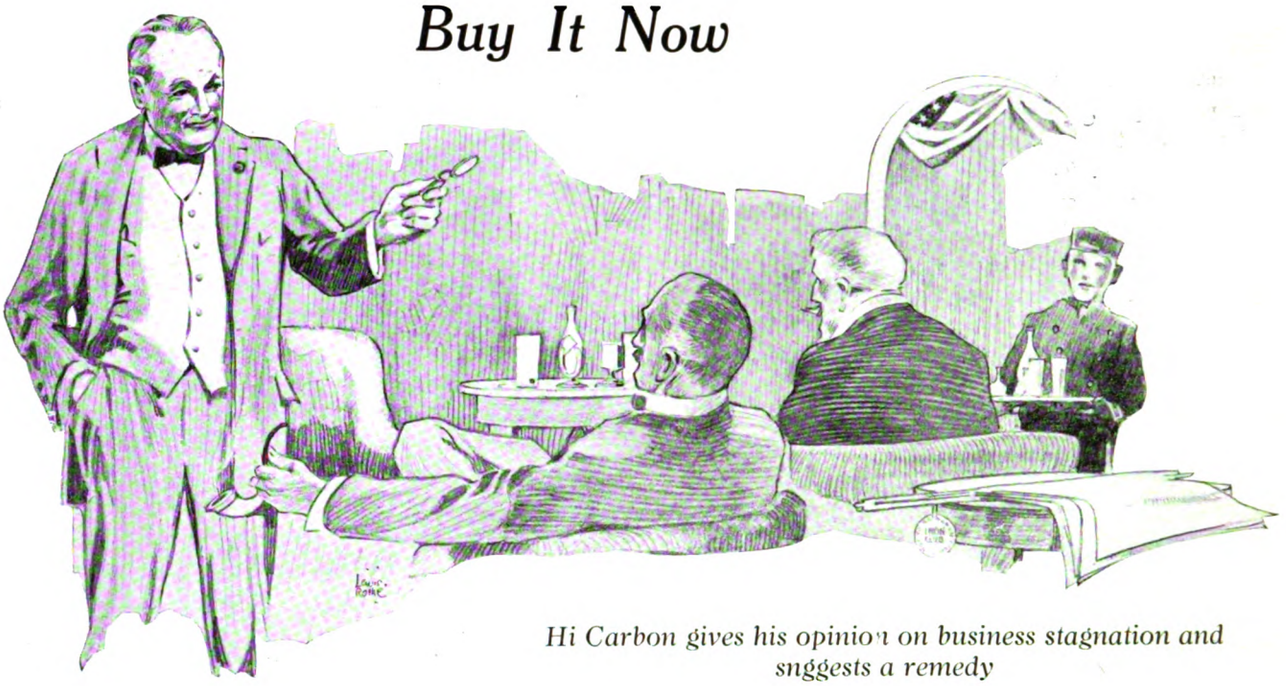

Hi Carbon gives his opinion on business stagnation and suggests a remedy

"These business prophets make me tired," remarked Pettigrew from the depths of his easy chair at the Iron Club one rainy Saturday afternoon in March. "Only a few months ago, and before that, you couldn't pick up a paper or magazine of any kind that wasn't loaded to the guards with all sorts of rosy pictures about great business booms, marvelous expansion of foreign trade, re-building devastated France and Belgium, and a sort of an industrial millenium that was a mortal cinch for the United States as soon as the War was over. Well, the War is over, practically at least, and look at the darn thing. So far as I can gather, we have on hand many times as much of almost everything, as we have any use for. The same, marvelous to relate, seems to be the case in 'stricken' Europe. What has happened, anyway? Are all the 'wise' ones of this country crazy, or simply boneheads?"

"Hanged if I know," replied Smithers, gloomily. "Business is making a noise like a flat tire. As if our labor troubles weren't enough without having the bottom drop out of the demand for everything. It is true enough that we have quite a lot of unfinished orders on hand, as a hold-over from the War period, yet, if we were running full force now, it wouldn't take so very long before it all would be cleaned up, and then there wouldn't be a thing in sight. Have you any real line on things, Hi?"

"Smithers, have you ordered that new lathe you talked so much about a few months ago?", said Hi, somewhat irrelevantly.

"No, I haven't," answered Smithers, wonderingly, "And I don't see what that has to do with it, either. However, now that you have asked the question, you know as well as I do, that prices have got to come down, and, although I certainly do need that tool the worst way, I am not foolish enough to buy it until I see how far prices will drop."

Hi smiled, and waited a minute before replying. Then he took up the question again.

"I know a chap, who gives me a lot of amusement at times. He is one of those slow-speaking, slow-thinking fellows, who occasionally emits some profound bromidic remark that always brings a good laugh. One evening, a few of us were sitting around the table after dinner over our cigars, and talking shop as usual. The subject was business depression, and everybody was airing his views on this perennial subject. This fellow was listening with his mouth open, and sawing wood, as usual. Finally a quiet moment came, and he heaved a sigh, and gave vent to this remarkable statement in his usual drawling undertone; "When nobody buys anything, you can't sell anything, and when you can't sell anything, it always makes hard times."

Smithers chuckled and Pettigrew laughed. "That fellow certainly was a wonder," said Pettigrew. "Where do you suppose he developed that remarkable theory?"

"You can go ahead and laugh all you please," continued Hi, "But nevertheless the present condition of affairs is directly traceable to those simple fundamental facts. If you want to go back far enough, consider the War as a creator of cataclysmic changes in the whole trend of human affairs. You will remember, that upon the outbreak of war early in August, 1914, business went to smash. All, or practically all, commercial intercourse with Europe ceased. A large proportion of our raw materials, metals, foodstuffs, cotton, and other commodities used to go to Europe to be manufactured into finished products, and re-sold to us. It stopped abruptly. The prospect of no markets for the output of our mines and

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farms, together with the psychological effect of the War itself brought about almost a complete paralysis. Soon, however, when the countries involved began to organize under the highest possible pressure to carry on the War to victory, new markets were created for our products, and the heydey of the munitions millionaire began."

"Just as suddenly as the War began, it ended, and, as usual, found business as poorly prepared for peace as it was for war. The pressure upon our industry was so intense during the War, that few of us were able to concentrate our minds on anything but the problems of the moment. It takes a sharp wrench to readjust all of our mental faculties to the present conditions, and it will take some months yet before we will be able to think clearly upon laying out the road to recovery."

"Just now, there is a surplus of many things that represent the basic industries of the country. I mean metals, and also foodstuffs. Copper, for instance, is in stock now to the amount of more than a billion pounds, and, in consequence, has shrunk in price to such an extent as to represent a serious loss to the producers on every pound that is sold at present prices. Do not forget that all the copper on hand now was produced on the basis of the war scale of wages and supplies. This surplus copper stock is not only in the United States but in England and France also. The same is true of the other base metals, such as lead, antimony, and others which were so much in demand for the manufacture of munitions."

"In recognition of the seriousness of the situation, the leading copper producers of the country got together, and resolved to curtail their output until there were signs of a return of activity, so the copper mines of the country are now operating at from 25% to 100% reduction of output. There was no way out of it. It simply had to be done, but it should be recognized as a temporary expedient only, and for the purpose of clarifying the situation pending the conclusion of formal peace with the Central Powers and a resumption of trans-oceanic commercial traffic without any of the war-time restraints, which are still in existence."

"The demobilization of our armies simply adds to the complications. At a time when war-buying has ceased, and there is no ready successor in the shape of peaceful industry, we are dumping on the labor market two or three million returned soldiers, who are entitled to first consideration for every available job."

"All of these things are jointly responsible for the present state of affairs, which is not confined to the United States alone, but prevails throughout the world. In fact, business is infinitely better here than in England or France, as we have suffered from only about one-third as long a period of war as our principal allies."

"Nevertheless, the 'business prophets', of whom you spoke, Pettigrew, knew their business, and told the truth when they said that there was a wonderful period of prosperity ahead of us, and it will be here almost before you know it, maybe in a few months. Right now, we, ourselves, are at least in part responsible for the present stagnation."

"How do you make that out, Hi?", asked Smithers.

"You answered that question yourself a few minutes ago when you told me why you hadn't ordered that lathe," replied Hi. "Most people are in the same state of mind as you are. You are not buying anything, because you are waiting for prices to reach what you think is rock-bottom. If, on the other hand, you were to consider how much valuable time you were losing, and went out and bought all of your necessities now, you, yourself, would be doing your bit to restore 'business as usual', and the whole situation would immediately lighten."

"People go around with long faces, and ask one another the question, 'How soon will business pick up?' The answer is that it will pick up as soon as we all do our part toward making it pick up, by going out and buying whatever we need to meet our immediate necessities, and do it now. The National City Bank says that conditions are appreciably better now than they were a month ago. There have been declines, but they have been orderly, and conducted in such a way as to produce confidence rather than fear. The volume of retail trade is still large. The steel mills are working at a pace that, previous to the War, would have been close to capacity, and new orders are coming in at a good rate, though not equal to production. Cotton goods are selling at about 35% less than the record high mark of last year, but stocks are being depleted, and the outlook is encouraging from that quarter."

"You think we should go out and buy what we want now rather than wait for still lower prices, Hi?", asked Pettigrew.

"I certainly do," answered Hi. "It is barely possible that, by waiting, you might save a little, at the expense of the waste of something far more valuable, and that is, time. I suppose your shop is shut down, waiting a settlement of the labor troubles. Why shouldn't you utilize the time thus on your hands by making such improvements, or changes in your equipment that you know must be made ultimately, anyhow? Why shouldn't you buy what you need in the way of staple supplies and get ready for the resumption of work? Another thing, don't look for any sweeping reduction in prices right away, for, if you do you are going to be disappointed. Has the cost of labor gone down? Not one bit, and the odds are all in favor of the present wage scale for a long time to come. The lowering of prices for base metals and some other things has no bearing on the cost of production, but is due to the large temporary surplus, and the softening in the demand. As I said before, every pound of copper that is sold at the present price, means a loss to the producers, excepting perhaps, those who have been mining under the most favorable conditions."

"I saw something in the paper the other day about some new Government Board, which was going to do something or other about price-fixing," said Smithers.

"Do you know anything about it, Hi?"

"It isn't a price-fixing board, Smithers," answered Hi, "The object of the Board is price stabilization. It is acting under authority of the Department of Commerce,

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and consists of six men. The Government recognizes how seriously the course of business is being interrupted by the present uncertainty in regard to prices, and is about to attempt to overcome that uncertainty. The plan, as it has been announced, consists of the arrangement of a series of conferences between the Board and the leaders of industry in each particular line. Of course the basic commodities are to be considered first, such as metals, cotton, and other staples. So-called 'fair' prices are to be determined, fair, of course, meaning fair to both consumer and producer in accordance with present conditions. These fair prices are to be made public, in order that everybody interested will know what the commodities he wants to buy are considered to be worth. There is no reason why anybody should not pay either more or less, if he can, than the price announced by the Board. No power is given the Board to make the prices mandatory. Everyone can do as he pleases so far as buying at the prices named is concerned."

"How is that going to help the situation?", asked Pettigrew.

"In this way, as I see it," replied Hi. "The psychological effect upon everybody will be marked. It will stiffen the back of the seller, who has been getting panicky for fear he might not sell his stuff at all, and at the same time it will reassure the careful buyer, who has felt it necessary to hold off from buying what he needs in the hope that prices might go still lower. After the Board gets thoroughly organized and running smoothly, I am inclined to doubt if there will be much variation between prices at which the basic commodities are actually bought and sold, and those determined by the Board."

"It seems to me that such a move ought to help," said Pettigrew, thoughtfully.

"It should, and undoubtedly will," replied Hi. "If to that move on the part of the Government, should be added the normal buying to meet necessities on the part of the people as a whole, there would be an immediate reaction from the present stagnation. The trouble is, that most of us fail to appreciate our own personal responsibility for the present state of affairs. We are quite anxious that 'buying' should commence again, that building should pick up, that the mines should return to their normal output, that the farmer shall find a ready market for his product, and yet, we don't buy anything we ourselves need, because we hope for further reductions in prices."

"In other words," said Hi, rising and starting for the hat room, "We are willing that George shall do it, and forget that we ourselves are George."

Analysis of Molding-Sand

In a recent article in 'The Iron Age,' F. Albert Hayes discusses the qualities required in molding-sand and methods of analyzing a given sand to determine its value. The author quotes Richard Moldenke's definition of an ideal sand as one consisting of uniform-sized rounded grains of silica, each grain evenly coated with the thinnest necessary layer of the most refractory and fattest clay to be had. While this ideal is, of course, unattainable, it serves as a basis for comparing commercial sands. Sharp grains of sand will give a better bond than rounded grains, but they afford less venting between the grains. The same kind of sand will not serve for all classes of work, but uniform results for the same kind of work are more likely to be obtained if the sand is also uniform. Screen analyses of each shipment of sand should be made, and the proportion of quartz, clay, and feldspar, and also the bonding power determined. This is particularly necessary because sand from the same deposit is not uniform. The ideal sand would contain 84% quartz, 13.5% clay, and 2.5% feldspar. On an average, maximum strength can be obtained by the use of 4% water. This also should be standardized for any given class of work, as there is great variation if the proportion of water is left to the discretion of the individual molder.

Methods of Handling and Conveying Material at the Best Company Shop

At the machine shop of the C. L. Best Gas Tractor Co. a system of handling small parts is used that not only gives the shop an orderly appearance, but also is a great saving of operators' time and expense in transportation. Most handling of material is accomplished by means of the Cowan 'transveyor', which is a three-wheeled master-truck with a hydraulic ram that enables a platform to be lifted far enough for clearance, with a few movements of the ram. The platform is made like a sled, of two-inch planks, with 2 by 8-in. skids, spaced so as to allow the truck to run between them.

The material is received and brought into the shop on a platform and taken to the first tool in its route. The machine operator takes the work from one platform and when the operation is finished places it on another. When a platform is full, a truck is run under it and it is moved to the next machine in the operation; in other words, the truck 'moves the floor.' Material is seldom placed on the floor, and then only the heavy pieces, which are handled by an electric industrial truck.

Several sorts of platforms are used at the Best plant. The illustrations show a special rack for crank-shafts, also a sectional bin that may be built to any height desired. In some plants, cast-iron and pressed-steel platforms are used for heavy work and all sorts of special racks and shapes are made for handling special material.

Investigators in factory transportation have found that it takes four times as long to load and unload material as it does actually to transport it. The lift-truck

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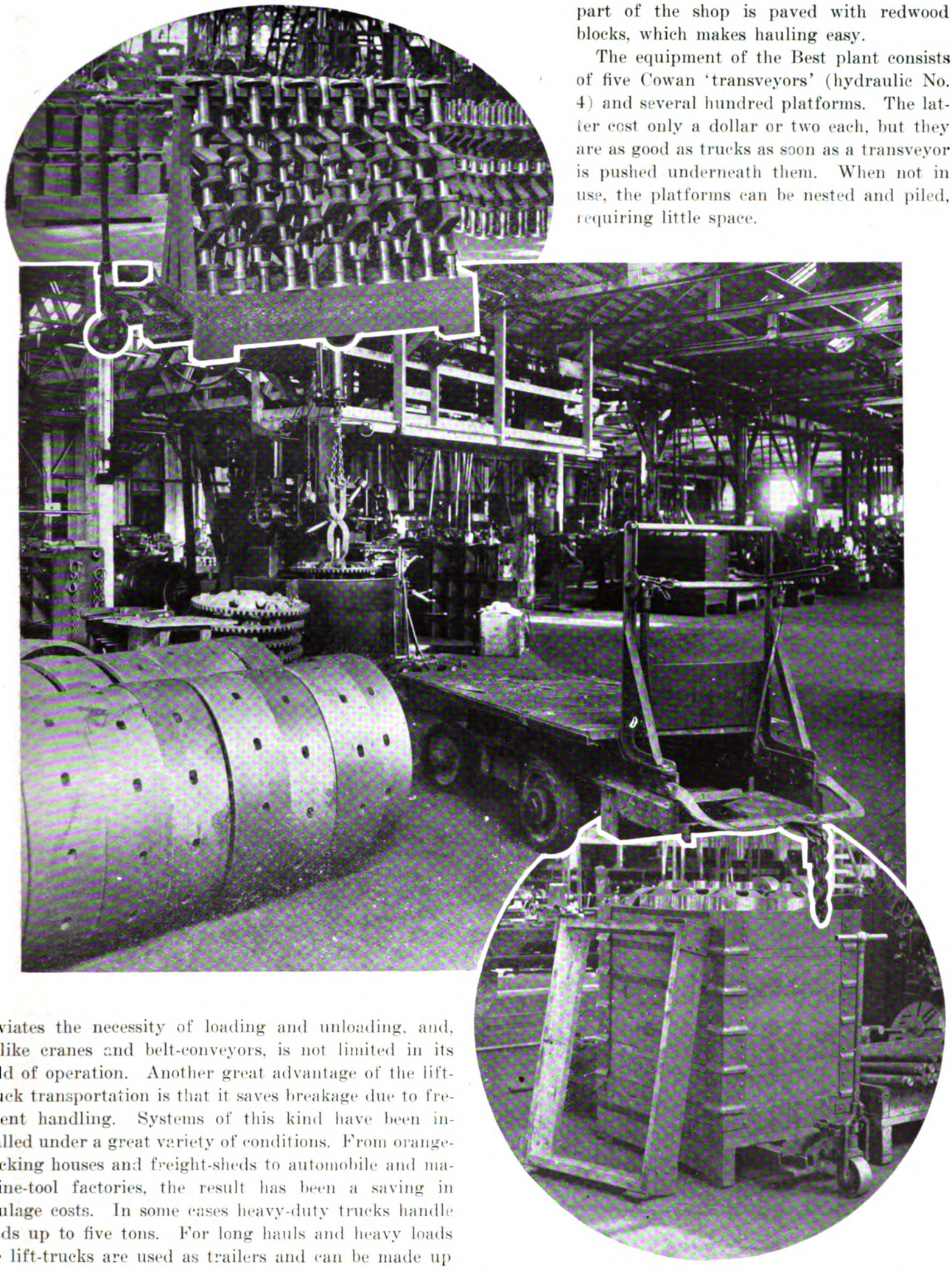

obviates the necessity of loading and unloading, and, unlike cranes and belt-conveyors, is not limited in its field of operation. Another great advantage of the lift-truck transportation is that it saves breakage due to frequent handling. Systems of this kind have been installed under a great variety of conditions. From orange-packing houses and freight-sheds to automobile and machine-tool factories, the result has been a saving in haulage costs. In some cases heavy-duty trucks handle loads up to five tons. For long hauls and heavy loads the lift-trucks are used as trailers and can be made up into trains behind the electric trucks.

In the Best shop the aisles are always kept clear and the material is piled neatly on platforms placed at convenient points behind the machine operators. The new part of the shop is paved with redwood blocks, which makes hauling easy.

The equipment of the Best plant consists of five Cowan 'transveyors' (hydraulic No. 4) and several hundred platforms. The latter cost only a dollar or two each, but they are as good as trucks as soon as a transveyor is pushed underneath them. When not in use, the platforms can be nested and piled, requiring little space.

ABOVE, SPECIAL PLATFORM AND RACK FOR CRANK-SHAFTS. CENTRE, PART OF MACHINE-SHOP, SHOWING ARRANGEMENT OF WORK AND METHOD OF USING PLATFORMS. BELOW, SECTIONAL-BIN TYPE OF PLATFORM.

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Heat Treatment of Low-Carbon Steel*

By W. M. WILKIE

IN annealing, the operation consists in (1) slowly raising the steel to its upper critical temperature; (2) holding it or soaking it at this temperature for a certain time, depending on the size of piece being treated and the condition of previous treatment; and (3) cooling from annealing to atmospheric temperature.

Theoretically, as the steel is heated to the lower critical point, the usual transformation from the phases of softened steel to austenite is commenced, and continues through the critical range, so that when the upper critical point is reached the steel should be all austenite. As a result of this transformation all pre-existing structures, no matter how coarse, are obliterated and the mass assumes an amorphous structure, providing sufficient time has been taken in heating to permit these changes to occur.

Further, if the temperature is carried above the upper critical point the tendency is for this amorphous structure to again become crystalline. Hence, in annealing steel its temperature should theoretically be raised to the upper critical point only, but practically there are conditions that modify this. For example, in cast steels we find that temperatures considerably higher (as much as 180°F. above the theoretical temperatures), combined with long soaking, are required to break up the coarse-grained structure.

Table 1—Annealing Temperatures for Steel

Range of carbon content, %	Range of annealing temperatures, F.
Less than 0.12	1607 to 1697
0.12 to 0.25	1544 to 1598
0.30 to 0.49	1499 to 1544
0.50 to 1.00	1454 to 1499

Mechanical work on steel seems to have the same effect, namely, it breaks up this intercrystalline film, and, as a result, we find that the more a piece of steel has been worked the closer the annealing temperatures can be kept to the upper critical point, while the nearer the steel is to the unworked or cast condition the higher the temperatures must be. The ranges of temperatures given in Table 1 have been recommended by the Committee on Heat Treatment of the American Society for Testing Materials.

The time of soaking depends largely upon the size of the object being annealed, but sufficient time should be given to permit the object to be heated throughout to the annealing temperature and allow the internal changes to occur. Pieces 12 in. thick require about one hour.

*Abstract from the 'Journal' of the American Society of Mechanical Engineers.

The rate of cooling after annealing is controlled by the product required. If a maximum softness and ductility is desired, for instance, for easy machining, we cool as slowly as possible, by either burying the article in a bed of insulating material or allowing it to cool in the furnace. If, however, we wish to retain a certain amount of hardness and strength we must cool faster, as in air or, if a low-carbon steel, in water, but to do so we must sacrifice a certain amount of ductility and softness. As a general rule, the lower the carbon the more rapid may be the cooling. For example:

1. Steels with carbon content below 0.15% can be quenched in water and remain ductile and at the same time have maximum hardness and strength.

2. Steels with carbon content below 0.30% can be quenched in oil with results similar to 0.15% carbon quenched in water.

3. Steels with carbon above 0.30% cannot be cooled so rapidly without destroying the ductility of the steel and so must be either cooled in the furnace, or in the air when extreme softness is not required.

The size of objects must also be considered along with the product desired. Other things being equal, the larger the object the more quickly must it be cooled, as long as the cooling is not so rapid as to set up strains.

As an example of the effect of rate of cooling on the strength of steel, we have a system of strengthening steels on high-explosive shells known as the Sandberg air-cooling method. By this method air at pressures ranging from 6 oz. to 15 oz., usually around 10 oz., is either passed around the shell-forging or forced to impinge on the revolving shell in such a way that a shell, which would normally cool in thirty minutes or more in the open air, is cooled in six to eight minutes. As a result the ultimate strength is raised, with an increase in the elastic ratio but with little variation in the ductility of the steel. This process is really an intermediate treatment between annealing and the regular hardening of steel, due to the formation of sorbite. Another way to get this sorbitic steel is to first quench steel from the upper critical range, thus retaining its fine-grained structure but leaving the steel very hard and without ductility. The steel is now re-heated close to but below the lower critical range, say, from 932 to 1202°F., when it loses its hardness and becomes ductile. The reason for this is that the steel has been changed from martensite to sorbite. This is really a hardening and tempering treatment, but is referred to here because it is sometimes called a double annealing treatment.

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The hardening temperatures in Table 2 are given by E. F. Houghton & Company.

Table 2—Relation of Hardening Temperature to Carbon Content

Carbon content, %	Hardening temperature, F.
Up to 0.20	1600 to 1650
0.20 to 0.35	1550 to 1600
0.35 to 0.50	1500 to 1550
0.50 to 0.70	1450 to 1500
0.70 to 0.90	1400 to 1450
0.90 or over	1350 to 1400

Steel is most commonly quenched in oil or water. In either case care must be taken, especially with high-carbon steels, to prevent cracking as the result of strains set up by too rapid cooling. If oil or water is used the object should be withdrawn from the bath before its temperature has fallen below 212°F., and the drawing or tempering treatment should follow immediately.

If a piece of polished steel is heated in an ordinary furnace, a thin film of oxides will form on its surface. The colors of this film change with temperature, and so, in tempering, they are generally used as an indication of the temperature of the steel. The steel should have at least one polished face so that this film may be seen.

An alternative method to the determination of temper by color is to temper by heating in an oil or salt bath. Oil baths can be used up to temperatures of 500°F.; above this, fused-salt baths are required. The article to be tempered is put into the bath, brought up to and held at the required temperature for a certain length of time, and then cooled, either rapidly or slowly. This takes longer than the color method, but with low temperatures the results are more satisfactory, because the temperature of the bath can be controlled with a pyrometer. The tempering temperatures given in Table 3 are taken from a handbook issued by the Midvale Steel Company.

Table 3—Tempering Temperatures for Steels

Temperature for 1 hour, F.	Color	Temperature for 8 min., F.	Uses
370	Faint yellow	460	Scrapers, brass-turning tools, reamers, taps, milling-cutters, saw-teeth.
390	Light straw	510	Twist-drills, lathe-tools, planer-tools, finishing tools.
410	Dark straw	560	Stone-tools, hammer-faces, chisels for hard work, boring-cutters.
430	Brown	610	Trephining tools, stamps.
450	Purple	640	Cold-chisels for ordinary work, carpenters tools, picks, cold-punches, shear-blades, slicing tools, slotter-tools.
490	Dark blue	660	Hot-chisels, tools for hot-work, springs.
510	Light blue	710	Springs, screw-drivers.

Two sets of temperatures are shown, one being specified for a time interval of eight minutes and the other for one hour. For the finest work the longer time is preferable, while for ordinary rough work eight minutes is sufficient, after the steel has reached the specified temperature. The rate of cooling after tempering seems to be immaterial, and the piece can be cooled at any rate, providing that in large pieces it is sufficiently slow to prevent strains.

How are we to know if we have given a piece of steel the very best possible treatment? The best method is by microscopic examination of polished and etched sections, but this requires a certain expense for laboratory equipment and upkeep, which may prevent an ordinary commercial plant from attempting such a refinement. However, I would certainly recommend any firm that has any large amount of heat treatment to do, to install such an equipment, which can be purchased for $250 to $500. Its intelligent use will save its cost in a short time.

The other method is by examination of fractures of small test-bars. Steel heated to correct temperatures will show the finest possible grain, whereas underheated steel has not had its grain structure refined sufficiently, and so will not be at its best. On the other hand, overheated steel will have a coarser structure, depending on the extent of overheating.

To determine the proper quenching temperature of any particular grade of steel it is only necessary to heat pieces to various temperatures not more than 36°F. apart, quench in water, break them, and examine the fractures. The temperature producing the finest grain should be used for annealing and hardening.

Similarly, to determine tempering temperatures, several pieces should be hardened, then tempered to various degrees, and cooled in air. Samples, say six, re-heated to temperatures varying by 180°, from 570 to 1470°F., will show a considerable range of properties, and the drawing temperature of the piece giving the desired results can be used.

The following precautions should be observed in the heat treatment of steel:

1. Do not put a cold piece of steel into a highly heated furnace. Either re-heat it or put it into a cold furnace and allow it to heat with the furnace. This precaution is especially applicable in cold weather. Remember also that the changes occurring in the critical range are not instantaneous. The steel must be given time to change. It does not pay to rush the heating. Raise the temperature slowly.

2. Allow the piece to soak at the quenching temperature until it is uniformly heated throughout, the length of time depending on the size of the piece and the rate of heating.

3. Do not allow the piece to be directly on the hearth of the furnace, but have it supported at a sufficient height for free circulation of gases on all sides. Long pieces should have sufficient support to prevent sagging.

4. Never allow a piece, especially if it has points or sharp corners, to come in contact with flame.

5. In quenching, immerse the piece with the axis vertical. This will prevent excessive warping or cracks due to unequal contraction in cooling.

6. Care should be taken that no sharp grooves, corners, or seams, which may develop into cracks, are left on pieces to be quenched.

7. In drawing the temper of a large piece in a furnace, never put it in a furnace hotter than the drawing-temperature nor allow the furnace to exceed the required temperature, otherwise the steel will be softer than required.

8. In drawing large pieces, soak a sufficient time at the desired drawing temperature, to allow the heat to affect the centre of the piece.

9. In annealing and quenching, never depend on the eye to judge the temperature; use a pyrometer.

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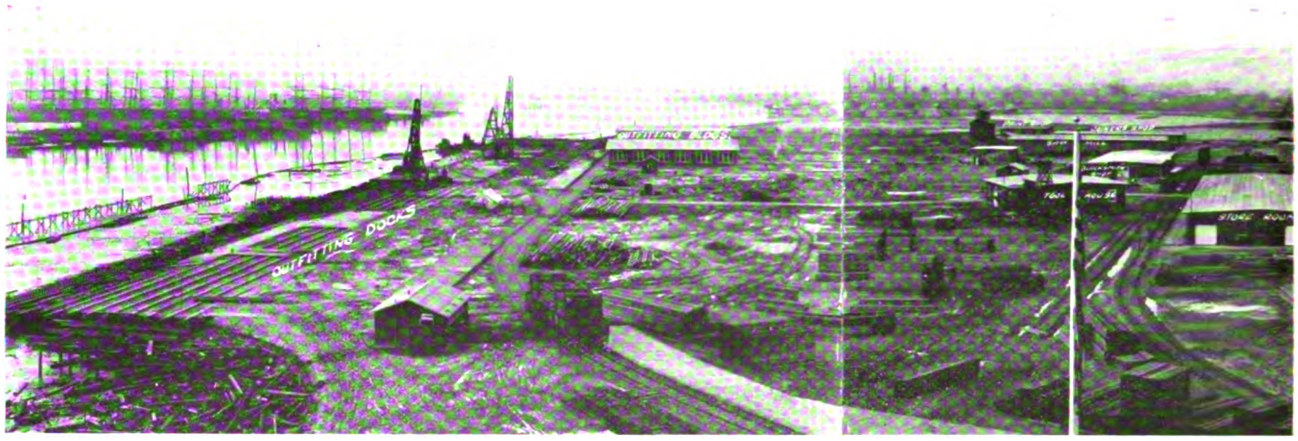

PANORAMIC VIEW OF THE CONCRETE

The Concrete Shipyard on the Oakland Estuary

FOR many thousand years wood was the only material used in ship construction. About the middle of the last century, iron and later steel were introduced, and steel ships soon became the world's standard. In the last year or so, the first sea-going vessels of concrete have made their appearance. The program of the Emergency Fleet Corporation provides for the construction of several vessels at five yards in various parts of the United States.

One of these yards is on the Oakland estuary, on the so-called Government island, a small island originally built up from material deposited by Government dredges working to improve the main channel. The island is a short distance west of the 23rd Avenue bridge. The ships are being built for the Emergency Fleet Corporation by the San Francisco Shipbuilding Co., the same concern that built the 'Faith'.

PLACING REINFORCEMENT

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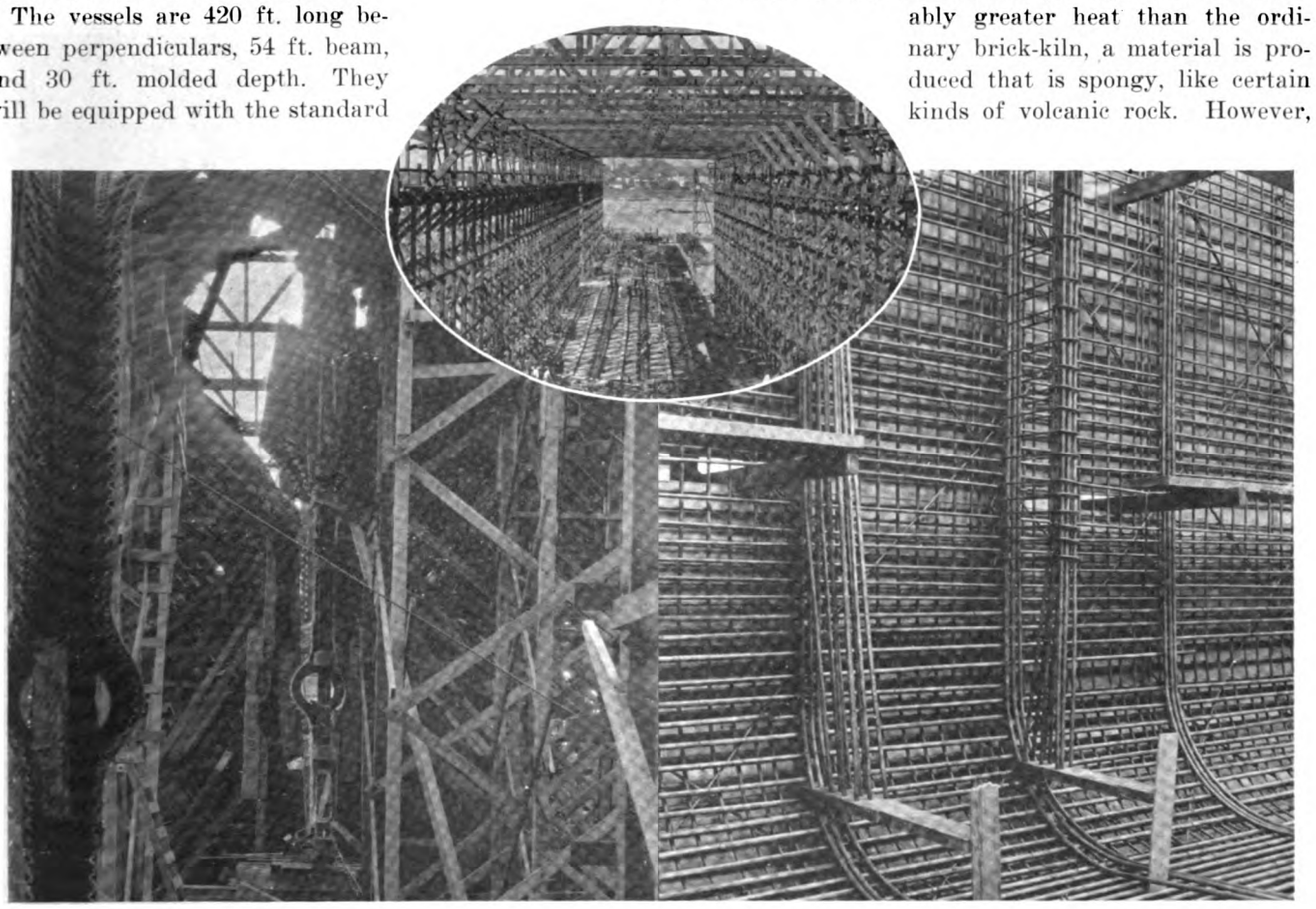
SHIPYARD ON THE OAKLAND ESTUARY

Work on the yard was commenced in July 1918 with the construction of a trestle connecting the island with the mainland on the Oakland side, and this was followed by dredging and grading the site. Two ways have been constructed on one side of the island, from which the ships are to be launched sideways and then towed around to the outfitting docks on the other side of the island. The present plans call for the completion of the two 7500-ton tank-steamers now under construction, and for building one 7500-ton freighter.

The vessels are 420 ft. long between perpendiculars, 54 ft. beam, and 30 ft. molded depth. They will be equipped with the standard 2800-hp. engines of the Emergency Fleet Corporation. Each vessel requires 2400 cu. yd. of concrete and 1600 tons of steel, or about 6% reinforcement, the proportion of reinforcement varying, of course, in different parts of the ship.

An important feature of the work has been the use of a very light aggregate for the concrete. This aggregate is prepared especially for the work by the Los Angeles Pressed Brick Co. By a process that consists mainly of moistening the clay and then subjecting it to a considerably greater heat than the ordinary brick-kiln, a material is produced that is spongy, like certain kinds of volcanic rock. However,



ABOVE, FRAMEWORK BEFORE PLACING STEEL OR FORMS. ON LEFT, STERN-FRAME IN PLACE. ON RIGHT, REINFORCEMENT FOR SIDE OF SHIP

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the small air-spaces do not connect with each other, and the concrete produced is impervious to water. After being burnt, this material is crushed to a maximum diameter of ⅜ in. A mixture of one part cement to two parts crushed brick is used. The strength-tests of this concrete are satisfactory, showing a compressive strength ranging from 3000 to 4000 lb. per square inch at 7 days. This concrete weighs about 100 lb. per cubic foot, or approximately two-thirds the weight of ordinary concrete, and the hull of a ship of this material will not be much heavier than the hull of a steel ship of the same carrying capacity.

On account of the difficulty in obtaining deliveries of the crushed brick, most of the concrete for the first ship was made from crushed terra-cotta aggregate. This concrete weighs 122 lb. per cubic foot, and is not so strong as the crushed-brick concrete.

Difficulty in obtaining deliveries also made the builders abandon their original intention of welding the reinforcing-rods, spot-welding where the rods of two systems of reinforcement cross each other and butt-welding the ends of rods together. However, a resistance machine suitable for the work could not be delivered in time. There is no doubt that such welding of reinforcement would be of advantage.

Pouring of concrete on the first vessel commenced in the latter part of February and took between two and three weeks to complete, after which pouring on the second vessel commenced. The first vessel will be launched early in April.

Heat Treatment of Alloy-Steels for Aeroplane Parts

A RECENT issue of the 'American Drop Forger' contains an article on 'The Heat Treatment of Aeroplane Parts', by Fred Grotts, chief metallurgist for the Curtis Aeroplane Co., from which the following data are abstracted:

Tests of brazed and welded joints that had been heat-treated compared with similar joints that had not been treated showed that the heat-treated brazed joints were 23% stronger than the untreated joints and that the treated welded joints were 28% stronger than the unwelded joints. The brazing material was 20% zinc and 80% copper.

In case-hardening material, it is kept at 1600 to 1650° F. for 6 to 12 hours, according to the penetration desired. It is then cooled in the boxes and removed and cleaned. The heat-treatment consists of heating to 1600 to 1625°F., to refine the core, and quenching in oil. Then the material is re-heated to 1425 to 1450°F. and quenched in water.

Forging material has an analysis of about 0.35% carbon, 0.65% manganese, 0.04% sulphur, and 0.04% phosphorus. The heat treatment consists of heating to 1550°F., quenching in oil, and drawing at 975°F.

Nickel-steel is used for bolts. The analysis is 3.65% nickel, 0.30% carbon, 0.55% manganese, 0.043% sulphur, and 0.04% phosphorus. On account of pipes and slag, much of this material has to be rejected. The claim that pipe can be removed by heat treatment is incorrect. The heat treatment consists of quenching at 1500°F. in oil and drawing at 1000°F. Nickel-steel will stand considerable cold working and furthermore it will not be affected as much as a similar plain carbon-steel by overheating, since its distorted structure becomes readjusted when it is re-heated to 1500°F.

Chrome-steel is noted for resistance to corrosion as well as high tensile strength. A typical analysis shows 10.44% chromium, 0.24% carbon, 0.36% manganese, 0.30% vanadium, 0.013% sulphur, and 0.020% phosphorus. This alloy is quenched at 1800 to 1825°F. and drawn at 850°F.

Two different alloys of chrome-nickel steel are used. One contains 3.5% nickel, 1.5% chromium, 0.35% carbon, 0.55% manganese, 0.04% sulphur, and 0.04% phosphorus. This is quenched in oil at 1475°F. and drawn at 820°F. The other alloy contains 1.25% nickel and 0.65% chromium, the other constituents being practically unchanged. This is quenched in oil at 1550°F. and drawn at 900°F. Piston-pins, stream-line wire, crankshafts, and connecting-rod bolts are some of the articles made of chrome-nickel steel. Sometimes improved results are obtained when double-quenching is employed. Piston-pins often crack when left in the quenching medium until cold.

Chrome-vanadium steel is used to a considerable extent for piston-pins and connecting-rod bolts. Double quenching gives the best results. Crankshafts and piston-pins should be quenched either horizontally or vertically in order to avoid internal strains. Two alloys are used. The first contains 0.45% carbon, 0.80% manganese, 0.04% sulphur, 0.04% phosphorus, 0.95% chromium, and 0.15% vanadium. This is quenched first at 1700° and again at 1600° and then drawn at 1000°F. In the second alloy, the carbon is reduced to 0.35% and the manganese to 0.65%, the other constituents remaining the same. The two quenchings are at the same temperatures but the material is drawn at 1200°F.

Vanadium acts as a cleanser of the molten steel, and even when its presence cannot be detected in the finished product, it removes nitrogen and oxygen. Vanadium also increases the tensile strength of steel. A typical analysis shows 0.22% carbon, 0.72% manganese, 0.039% sulphur, 0.04% phosphorus, and 0.18% vanadium. Up to 0.7% vanadium, the strength of the steel increases.

Among the non-ferrous alloys, duralumin is one of the most interesting. It contains 94.92% aluminum, 3.43% copper, 0.40% iron, 0.74% magnesium, 0.47% silicon, and a trace of manganese. The first samples were taken from the framework of a Zeppelin. Although almost as light as aluminum, it has about the same tensile strength and elongation as mild steel. It is treated by heating to 900°F. and quenching in water.

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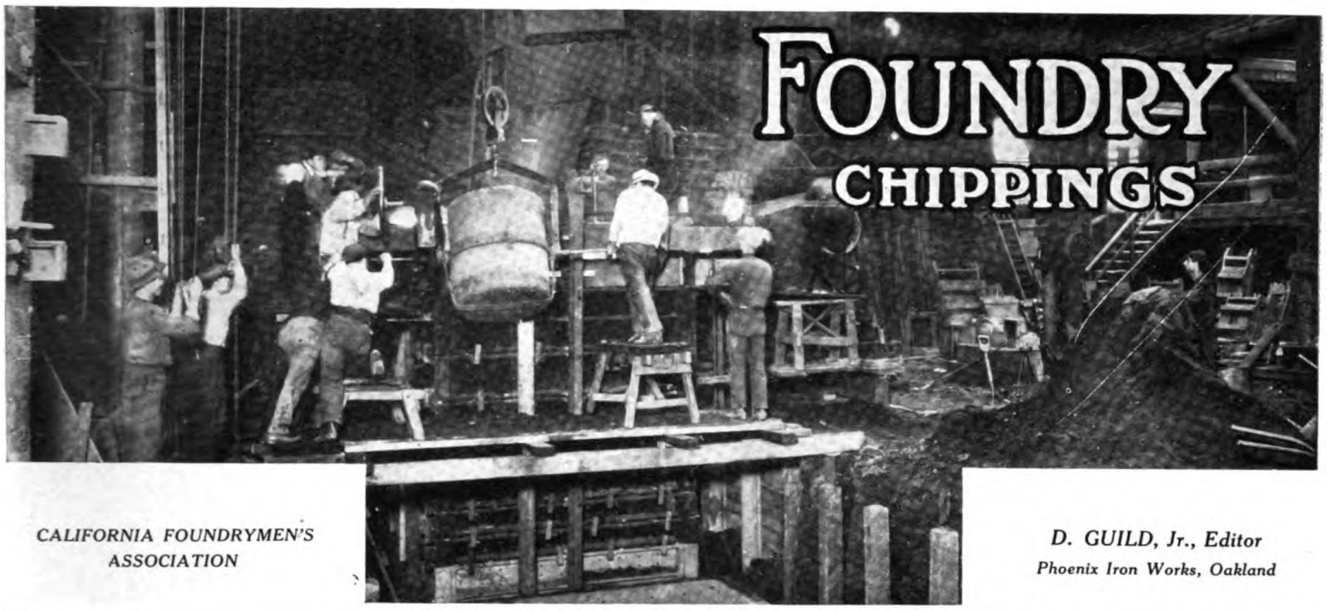

CALIFORNIA FOUNDRYMEN'S ASSOCIATION

D. GUILD, Jr., Editor
Phoenix Iron Works, Oakland

The Need of the Working World

By JOHN F. KELLOGG, JR.

Educators are giving more and more attention in these days to the need of special courses in our schools and colleges, which will fit our young men for industrial life. The Federal Board of Vocational Education is advocating revolutionary changes in our public-school system. Those who must prepare to take up the wage earning pursuits in agriculture, industry, or commerce will, in the future, receive from the public school, education which will be adapted to their needs.

Not only are educators realizing this need, but employers are also beginning to see the need of training for the employee. Joseph J. Tynan, general manager of the Union Plant of the Bethlehem Shipbuilding Corporation, has recently launched a campaign of education, which will tend to increase production and thus permit paying higher wages. An instructor of mathematics, formerly with the University of California, will hold classes each evening from 7 to 9, for Union Iron Works employees, in one of the San Francisco schools. The Southern Pacific Co. not only maintains its schools for station agents, telegraphers, and clerks, but also has a school for waiters where their trade is taught.

In order to ensure for itself a supply of trained foundrymen for responsible positions, the Westinghouse Electric & Manufacturing Co. has recently established a course in foundry work for those of its employees between the ages of 17 and 21 years who have completed at least the eighth grade of public school or its equivalent. The shop courses will include the following: Bench and floor molding; machine molding; core-making; tempering of sand; cupola operation; mixing of alloys and cost calculating. Instructions will be given during the course in blueprint reading, mechanical drawing, shop problems, and metallurgy.

It is evident that labor is not to be left behind in this movement, for the plans for the new labor temple at Oakland include classrooms where the men may be taught the fine points of their trade. Efficiency is not a thing of which to be afraid, but rather it should be embraced, for it is the real solution of the higher wage question.

Birthday Greetings

A pleasant surprise dinner-party was tendered to John Hedley in honor of his 70th birthday on the evening of February 25, at the home of John Cope, 1444 16th avenue, San Francisco. The feature of the evening was the delightful and sumptuous dinner prepared by Mrs. Cope. The guests at the dinner comprised a few of John's most intimate friends, and everyone enjoyed it greatly. During the repast, congratulatory remarks were made by the old standby, William Lauten, and he certainly left nothing unsaid. In response, our dear old Hedley made a few remarks about each one around the table, commencing at his right and continuing until all of the friends had been personally greeted. John concluded his remarks by speaking of his own life as a foundryman.

At the conclusion of the response, to John's great surprise, the orchestra, which had been concealed in the adjoining room, struck up the tune, "For He's a Jolly Good Fellow," which show of the affection and esteem of his friends almost took John off his feet.

During the evening the orchestra rendered several selections under the leadership of our good old friend John. The program was followed by dancing, which lasted until a late hour. A peculiar and interesting feature of the evening was that John blew out 69 of the 70 candles on the birthday cake, with one blow.

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INTERIOR OF MOORE BRASS-FOUNDRY

Brass Foundry at the Moore Shipbuilding Plant

The latest addition to the plant at the Moore Shipbuilding Co. yard is the brass-foundry. This is a galvanized corrugated-iron building 50 by 90 ft., equipped with a ten-ton traveling crane and three Swartz furnaces, two of these being 60 in. and one 30 in. diam. The building was designed for capacity of two tons per day, but the actual output is three tons. Even this capacity is not sufficient, and an addition, 20 by 30 ft., is being built, which will be used for cleaning and storing castings.

The principal products of the foundry are manganese-bronze propeller-blades and brass and bronze valves and fittings. During the past 30 days, ten of these blades, weighing about 4000 lb. each, have been completed, all of them perfect castings. The U. S. Shipping Board requires a tensile strength of 55,000 lb. per square inch in these blades. To ensure good castings, the Moore Shipbuilding Co. decided to use virgin metals in this work. Test-bars from the first ten blades shows tensile strengths ranging from 64,500 to 69,300 lb. per square inch with elongation from 43 to 46%.

The foundry is equipped with two core-ovens, one of brick, 6 by 12 by 8 ft., and the other a small sheet-iron oven. In the cleaning department there is a wet-rumbling barrel, a spruce-cutter, and several emery-wheels, pneumatic hammers, and other equipment.

The decision to construct the foundry was made about the middle of November 1918, when the U. S. Shipping Board changed its specifications for propeller-blades from steel to bronze. The design and construction of the building was done by company forces. The building was completed and the foundry running 25 days after ground was broken for the foundations.

The Shop Bulletin-Board

Safety bulletins are wasted unless they are read by the men in the shop. When the bulletins come in do not put them safely away in your desk. Put them on a board in the shop. A bulletin-board in the office is of no value to your plant employees. Post the bulletins where the men in the shop can see them, better still, put them where they can't help seeing them.

A few suggested places are:

1. Drinking-fountains.
2. Locker-rooms.
3. The time-clock.
4. Wherever the men assemble (indoors or out).
5. Every room and department in the shop.

Don't wait. Do it *now*. Make your accident-prevention campaign live and convincing. Make it as vital as the daily paper in the life of every employee in your shop.

FOREMAN: What! You want a raise? Why when I was an apprentice I had to work a year before I got one."

Apprentice: "Yes, sir, but perhaps you was one of those fat-head kids that ain't worth a raise."

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Bull-sheviki

The story is told of a progressive young foundryman who recently acquired enough money to open a little shop of his own. His office was the most important and ornate part of the plant. One morning before the plant was in running order the young fellow was seated at his desk when the first prospective customer entered the door. Hastily taking down the telephone receiver he commenced:

"Oh, yes, sir. Yes, I think we can agree to those terms. You say you want five hundred off each pattern. Oh surely, the price of $5000 for the job is the lowest figure we can make. We are quite rushed just at present, but as soon as we finish one other large contract we will commence on your work. You say you will be here in the morning to sign the contract. Very well, I will be here about nine. Goodby, sir."

Hanging up the receiver, this busy person turned to the man who had entered the office.

"Is there anything I can do for you, sir?"

"Naw, not a darn thing," returned the visitor, "I have just come to connect your telephone, that's all."

Personal

W. W. Mills of the Phoenix Iron Works, who is an expert on steel production, left recently for New York to interest Eastern capital in his work.

C. J. P. Hoehn of the Enterprise Foundry Co. visited Los Angeles recently. Charlie says that he likes it down there, but we notice that he always comes back. At least, he has so far.

It is rumored that after July 1 Johnnie Cope of the Western Foundry is going to change his name to Johnnie Flask. He feels that he can do this safely without any conflict with the Dry forces.

Secretary Thille has abandoned the care-free kitchenette and folding-bed life of the city for life in a real house out near the ocean. He says he likes it out where the neighbors live half a mile away and where he can raise purps.

They say that Davy Guild carries a complete extra Ford in the tool-box of his 'Lizzie'. There is only one thing he lacks and that is a tow-rope.

Two travelers who always make a point of partaking of the characteristic dish in any part of any country visited, Devonshire cream in Devon, polenta in Italy, scrapple in Philadelphia, baked beans in Boston, Lake whitefish in Chicago, and so forth, arrived in Montana.

"Let me see," said one of the travelers to the waiter at their first meal in the Butte hotel, "what is the native and characteristic dish of Montana?"

"I dunno," replied the water, gravely, "unless it is canned tomatoes."

Question Box

We are going to start a question-box page, but it will not be conducted in the usual way. The questions will be printed but no answers will accompany them. They will be used to stimulate thought and the production of material for articles in Chippings. If you feel that you can answer any of the questions that appear, we will be glad to print the answer you send. The questions printed this month are some that have been on file in this office for some time. However,they will do to start the column. Send your answers to the secretary. Also send additional questions.

1. When did the cast-iron age begin?
2. For what purpose were the first commercial iron castings made?
3. What percentage of manganese is lost in the cupola?

Announcements

The regular monthly meeting of the Association is held on the third Thursday of each month at 11 a.m.

The Ways and Means Committee meets every Tuesday at 11 a.m. in the Association Assembly Hall.

It is the desire of the Ways and Means Committee to co-operate with the foundrymen to the fullest extent. If you have any commercial problems that you feel the Committee may be able to help you solve, you are cordially invited to attend the meetings and present same. If you have any suggestions to make or have any constructive ideas looking toward the standardization of the foundry industry, pass them on. It is only through such helpful co-operation that concrete results can be gained.

Owing to the unsettled conditions in the metal industry it has been decided to discontinue the meetings of the Foundrymen's Club. For this reason the publication of 'Chippings' will not be resumed as was announced in the last issue of 'Metal Trades'.

"Your honor," declared Officer McPherson, "I heard an awful yellin' back in the wagon yard, and when I got there this man was beating his wife."

Judge Broylesh turned sharply on the prisoner, a tall gaunt farmer, with clay-colored complexion.

"Is this true? Were you beating your wife, sir?" demanded the judge.

"Yes, your honor."

"How did you come to do it?"

"Lord knows, jedge. For 20 years she alluz wuz th' one what did the beatin', but I jes' happened to catch her when she wasn't feelin' right.

After all, the old time name of 'hobo' was easier to pronounce that the new name 'Bolshevik'.

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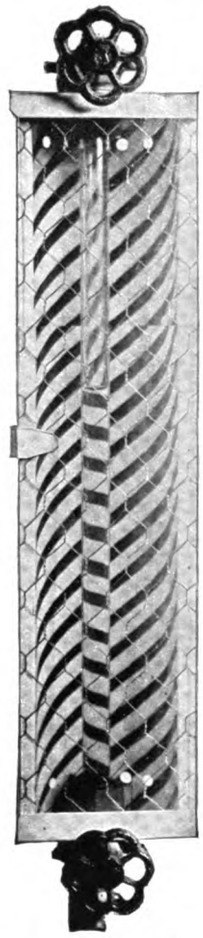
INDUSTRIAL EQUIPMENT

SWIVEL GUARD FOR GAUGE-GLASSES

A useful guard for gauge-glasses on boilers, which at the same time assists reading the gauge, is manufactured by L. F. Grammes & Sons, Allentown, Pa. It is made of brass with a white-enameled reflecting-surface, which has diagonal red lines. The refraction of the light passing through the



Gauge-Glass Guard

water-column changes the direction of the lines to a marked degree. This makes it easy to read the gauge from any position. The guard has a heavy wired plate-glass front, which furnishes complete protection in case the gauge-glass breaks.

PULVERIZING AND BLOWING MACHINERY FOR POWDERED COAL

By F. B. Coffin

*Electric power is probably used more extensively in the preparation and handling of pulverized fuel, on the basis of kilowatt-hours per ton, than is the case with any other form of fuel. One possible exception is briquetted fuel. In this country, however, the amount of fuel briquetted is small [477,235 tons in 1918]. Electric power is used for the following operations in connection with pulverized fuel: Crushing the coal to 1-inch size or less; energizing magnetic separators; rotating the dryer-drums; pulverizing the coal; elevating lump and pulverized coal; driving screw-conveyors; driving feed-screws for burners; driving reciprocating air-compressors for high-pressure air, transport systems, and blast-feed to burners; driving centrifugal air-compressors for supplying air for combustion at a pressure of 1 lb. per square inch; and driving low-pressure blowers for supplying air for combustion at lower pressures, and for conveying coal in suspension through pipes; also for separating the finished product from the unfinished in pulverizing.

No one plant uses power for all of these items, as the list includes the component parts of several different systems for preparing and handling pulverized coal.

The amount of pulverized fuel used in the United States at mid-1918 was 10,000,000 tons, divided by industries approximately as follows: manufacture of cement, 6,000,000 tons; iron and steel industry, 2,000,000 tons; production of copper, 1,500,000 tons; and generation of power, 100,000 to 200,000 tons.

The requirements of one representative system of preparing, conveying, and burning pulverized coal are 35 hp-hr. per ton. With a motor efficiency of 89%, this corresponds to a power consumption of 29.4 kw-hr. per ton.

These pulverizers are a type commonly used for pulverizing coal

Some systems require less power and others more, according to the methods used in pulverizing and conveying. Air transport systems require more power for their operation than mechanical systems, but have the advantage of greater simplicity and flexibility. Assuming an average consumption of 30 kw-hr. per ton, for the 10,000,000 tons used, the yearly power requirements will be 200,000,000 kw-hr. As many of the furnaces using pulverized coal have to operate fairly continuously, we will assume an average yearly operation of 5000 hours out of 8760. At this load-factor, the average power consumption will be 60,000 kw. If 2.5 lb. of coal are consumed in the power station per kilowatt-hour, this corresponds to 375,000 tons yearly for preparing and handling 10,000,000, or 3.75% of the total.

When burning other fuels there will be a corresponding charge which will vary according to the fuel and the method of firing. When atomizing oil with a steam jet, the amount of steam consumed is from 2 to 3% of the total steam generated in an oil-fired boiler. In addition, power is required for pumping the oil and for the blowers, which maintain the air-blast. This is an extravagant way of burning oil, but requires the least equipment. Pumping oil through mechanical atomizers is a more efficient method of burning. In power-stations, the stokers require power for actuating the fuel-feed, and for the under-grate air-blast. In addition, power is required for crushing and conveying the coal. With pulverized fuel the combustion is more complete and the stack loss is reduced. The result is that the net efficiency is a little better with pulverized coal under test conditions; and taking the human factor into consid-

*Abstract from 'General Electric Review'.

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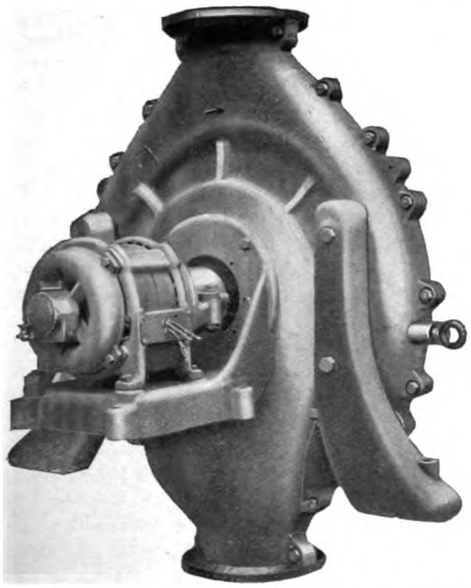
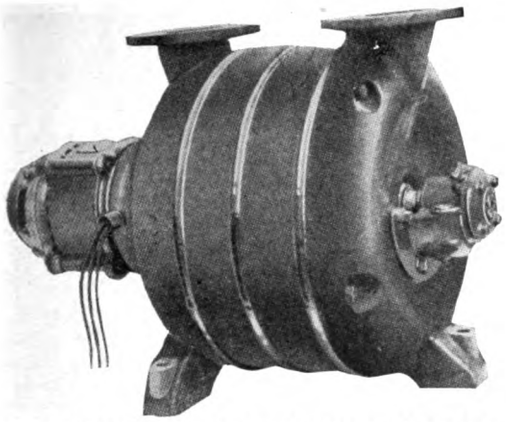
eration, it should be easier to maintain operating efficiencies which are more nearly comparable to those attained in test. It is evident, therefore, that the power charges against the preparation and handling of pulverized coal are offset by the more efficient utilization of the fuel. By the use of



Centrifugal air-compressor with capacity of 3300 cu. ft. per min. at 1 lb. per sq. in. This machine is used for blowing pulverized coal into open-hearth steel furnaces.

off-peak power for preparing pulverized fuel the comparison can be made still more favorable and a margin provided to absorb other charges, such as labor at the pulverizing plant, when the installation is of sufficient size. If this be the case where the margin is smallest, it must be more marked in



Three-stage centrifugal air-compressor with capacity of 250 to 350 cu. ft. per minute at 1½ lb. per sq. in. This type of machine can supply the primary air to pulverized coal burners at any pressure from ½ to 3¼ lb., by varying the number of stages from 1 to 6. The power required is from 2 to 8.5 horse-power.

the case of metallurgical furnaces where the fuel saving is greater than is possible in a modern boiler-plant. Considerable fuel economies are possible, however, in boiler-plants having old-style stokers or where hand-firing can be superseded.

SAFETY RESPIRATOR

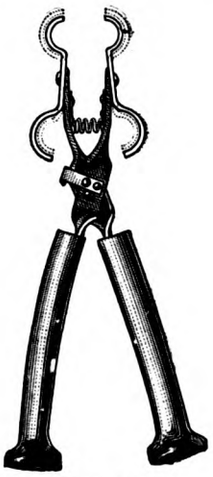
In plants where dust or injurious fumes are unavoidable, the Goodrich Safety Respirator, which is handled by L. F. Grammes & Sons, Allentown, Pa., is of service. This respirator is worn over the nose and mouth, and consists of a well-molded and snugly fitting outer casing of rubber, provided with adjustable straps. The interior contains a double filter of fine silk, backed by a sponge that may be

Respirator for Use in Shops

used either dry or else saturated with plain water or some medicated preparation.

NON-SHOCK FUSE-PLIER

The removal of fuses on high-voltage lines is a source of considerable danger, particularly where the workman hap-



Fuse-Plier

pens to be standing on damp ground or on some conductive substance. By using the fuse-pliers shown in the illustration, which are manufactured by L. F. Grammes & Sons, Allentown, Pa., all danger from shock and burns is avoided.

The Independent Pneumatic Tool Co. has issued a circular describing the Thor line of Universal electric drills. The motors are superpowered and cannot be stalled on full load. They can be operated on either direct or alternating current and are made for either 110 or 220 volts. Aluminum crank-cases are used on the smaller sizes to ensure lightness and portability. The Thor is said to be the only portable electric drill made with ball and roller bearings throughout. Thor tools to the number of 67,322 were sold during 1918. These went principally to 192 shipyards. Machine-shops, boiler-shops, foundries, and automobile factories took the rest.

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PRESERVATION OF HOT-WATER SUPPLY-PIPE

By F. N. Speller* and R. G. Knowland

†The principles involved in the corrosion of iron and steel have been so frequently discussed during the last few years and so clearly enunciated by various writers that a further attempt may seem a little unnecessary. That the problem is not yet generally understood, however, is apparent from the tendency of some writers to confuse many of its essential facts. Such a confusion is not warranted in view of our present knowledge of the mechanism of corrosion and of the factors controlling it. There are a few broad simple principles applying to every case of corrosion and these will be briefly discussed with particular reference to hot-water supply systems.

With reference to corrosion it is possible to classify any

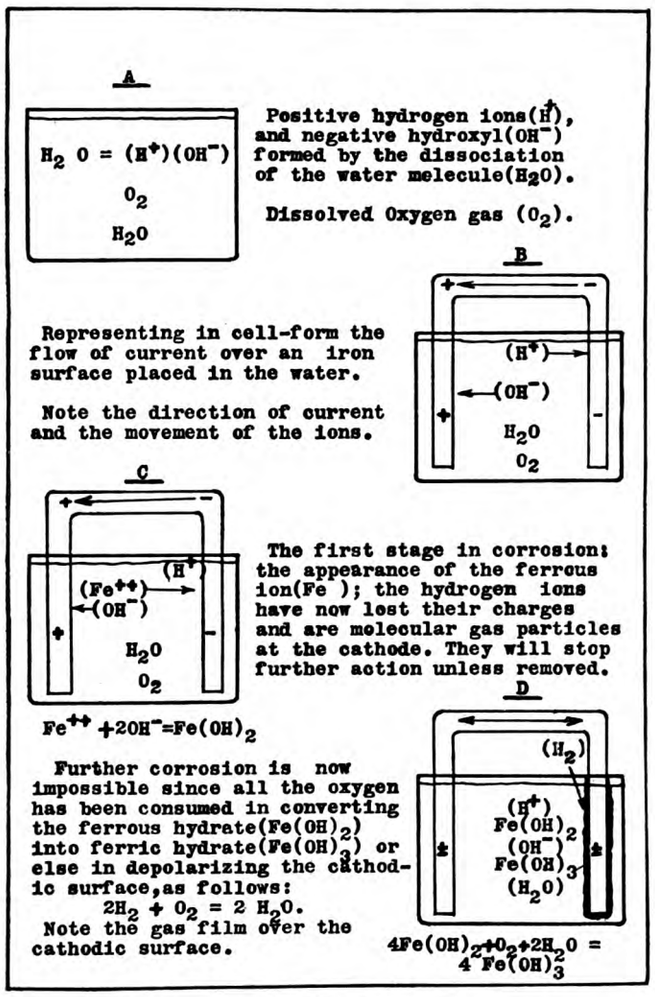

Fig. 1. The Electro-Chemical Mechanism of Corrosion

particular water under one of two types which may be distinguished by the terms 'active' and 'inactive'. The quality of activity is not primarily dependent upon the acid, alkaline, or neutral condition of a water; but rather upon certain dissolved substances, which exert a modifying influence upon the universal tendency of even the purest water to initiate the corrosion process. This inherent tendency of pure water to attack metal may be greatly aided in those cases where dissolved gases exist in the liquid; and under such conditions the term 'active' typifies its corrosive qualities. An inactive water is one that is not able to promote in any marked degree the corrosion of iron. The sharp boundary between the behavior of these two types of water furnishes a sufficient reason for thus distinctively classifying them. It is a simple matter to demonstrate the fact that an inactive water, after a few minutes aeration, becomes capable of great damage to iron. Fig. 1 shows the steps in corrosion.

By keeping hot water under pressure in contact with a large surface of iron for sufficient time it is possible to remove and 'fix' the oxygen. It is this process of fixing the O that renders water practically inactive or non-corrosive. A successful adaptation of this method is shown in Fig. 2 and 3. The deactivator or treating tank, consists of a Gurney coal-fired heater, a treating and storage tank, and a filter as shown by Fig. 2. The tank was built with a 42-in. flanged head, thus permitting easy packing of the Cambridge metal-lath with which the tank was filled in horizontal layers from bottom to top. In circulation, as the arrows indicate, the water passes from the heater up into the deactivating tank, where it makes contact with the sheet-metal at a high temperature. It moves through this slowly as cooling currents or water from the cold supply urge it, and back into the heater or off through the building supply-line.

The hot-water house supply-pipe leaves the tank at the top and passes to the filter, part of its contents being shunted

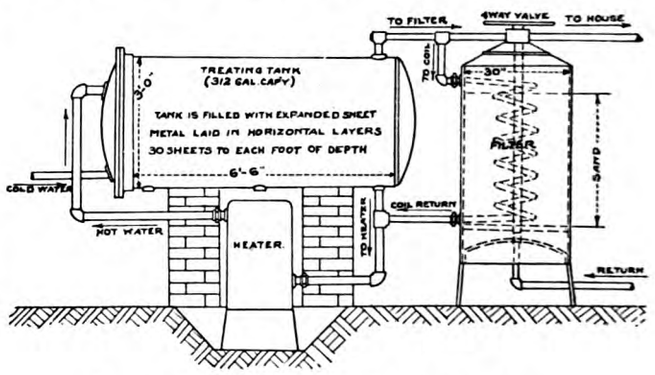

Fig. 2. Water-Heater and Deactivator for Building

off through a coil in the filter-bed. A constant circulation of hot water in this coil makes it impossible for the filter to reach a temperature notably lower than that in the deactivating tank itself. Through a four-way valve at the top of the filter, the water for circulation in the building system passes into the space above the filter bed and down through the sand into a chamber at the bottom. In this passage, the rust formed in the deactivation of the water is wholly removed. The building supply is withdrawn through the vertical pipe in the centre of the filter, while the gravity return-line entering at the bottom provides for a continuous circulation of water. It is thus apparent that we have three complete and independent systems of circulation: (1) the one between the heater and tank, (2) that between the filter and tank for keeping the former hot, and (3) the building and filter system. This installation was highly successful, whereas previously troubles were many and expensive.

A notable instance of the successful treatment of hot water was at the Irene Kaufman Settlement. Pipes were laid on November 22, 1916. On December 24, 1917, the wrought-iron and steel pipe was found to be practically uncorroded; but in duplicate pipes in part of the same hot-water system, unprotected by the deoxidizer, there had been perforation by corrosion. On January 3, 1919—or 2 years and 42 days service—the pipes in the deactivated hot-water line were again observed, and found to be so good that it

*Metallurgical engineer, National Tube Co., Pittsburgh, Pennsylvania.

†Abstract of paper prepared for the American Society of Heating and Ventilating Engineers, New York.

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was decided to continue the test for at least another year. The pipes showed the same soft black coating as before, but

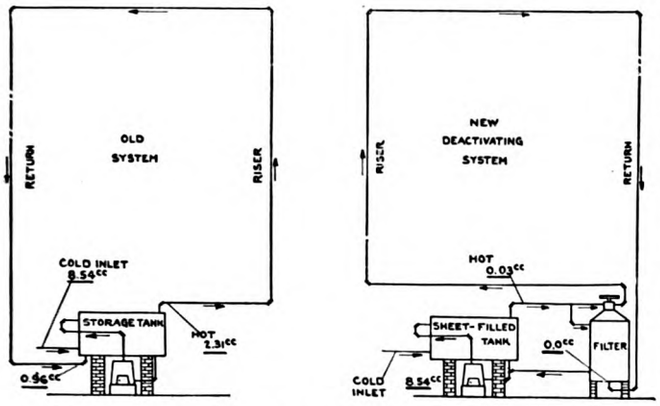

Fig. 3. Hot-Water System in Buildings Showing Free Oxygen in Water at Various Points

there was no evidence of pitting, even where the steel pipe was in contact with a brass union, a condition favorable to rapid corrosion by electrolytic action.

PONTOON-CRANE AT MARE ISLAND

The accompanying illustration shows the great 150-ton Wellman-Seaver-Morgan pontoon-crane being tested at Mare Island. The load is 210 tons of armor plate. The purpose

Crane Under Test

of the crane is to handle the heavy guns, turrets, armor-plate, and similar heavy articles on the battleships built or repaired at the yard. A duplicate of this crane at the Norfork Navy Yard has been used for raising a sunken tug, launching small boats, fitting out ships, and placing boilers. The Mare Island crane has a rated caparity of 150 tons. The main hoist is fixed on the jib, which is raised and lowered and has a radius of 70 ft. The auxiliary hoist of 25 tons travels along the jib and has a reach of 80 ft. overside. The pontoon is 85 by 140 by 15 ft. and has a maximum list of 6% with 2 ft. minimum freeboard. The deck storage-capacity is 300 tons. The crane is electrically operated with Westinghouse equipment. The power-plant is self-contained, a 150-kw. generator being direct-connected to a compound engine. The boilers are oil-fired.

SHORT COURSE IN OXY-ACETYLENE WELDING

Under the above title, the **Air Reduction Sales Co.** has issued a folder containing the outline for a course in welding written by Alfred S. Kinsey, professor of shop practice, Stevens Institute of Technology. Mr. Kinsey was the organizer and director of a special war-course in oxy-acetylene welding and cutting at the 23rd Street Young Men's Christian Association, New York. The course is designed for technical schools and consists of 12 periods. An outline is given of the subjects to be discussed by the lecturer, and suggestions are made regarding the practical work to be undertaken by the student after each lecture. A color plate is included in the folder illustrating the different types of flames. Copies may be obtained from the main office, 120 Broadway, New York, or from K. L. Brackett, district manager, Emeryville, California.

Trade Notes

Rosenberg & Co. will construct a $250,000 rice-mill at Colusa.

The U. S. Engineer Office, San Francisco, will open bids on April 24 for dredging in Oakland harbor.

The **Seattle Brass Co.,** Seattle, has increased its floor-space and other facilities, bringing its total capacity up to eight tons per day.

Plates have been laid down at the **Mare Island Navy Yard** for an all-welded barge. It will be 80 ft. long, 40 ft. wide, and 4 ft. draft.

Chester Mott has been appointed manager of the Denver office of the **Sullivan Machinery Co.,** succeeding **Wallace T. Roberts,** resigned.

The foundry of the **Marchant Calculating Machine Co.** has been sold to Gordon Marchant and will be operated as a commercial foundry.

An election will be held May 6 in Fresno county to vote on a bond issue of $4,600,000 for the construction of a county highway system.

The Pan-American Petroleum Co. has purchased 15 acres at Vernon near Los Angeles and will construct an oil-refinery. The estimated cost is $250,000.

The **Central California Tractor Association** has decided to abandon the tractor demonstration, which was to have been held near Fresno in the latter part of April.

The State Board of Harbor Commissioners has awarded a contract for the construction of an addition to pier 43 to **J. D. Hannah.** The contract price is $38,437.

C. B. and B. E. Cox have purchased the **Moznett Welding & Machine Works** at 224 East Channel street, Stockton, and will increase both the welding and the machine-shop equipment.

W. P. Callahan has opened an office in the Monadnock building representing the **Defiance Machine Tool Co., Fox Machine Co., Guarantee Paint Co., Witte Engine Co.,** and a number of others. Mr. Callahan has been in the manu-

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facturing business in the East for many years, and is well acquainted with the needs of manufacturers in the metal industries.

The Rothert Process Co., 622 Harriman street, Seattle, is increasing its facilities so as to bring the capacity of its plant up to 10 tons per day of high-carbon steel and high-speed steel.

The **Keystone Iron & Steel Works,** of Los Angeles, will construct several reinforced concrete buildings, including a foundry, an office, and a warehouse on Santa Fe avenue near 27th street.

The **Dawson Construction Co.,** of New York and Philadelphia, has been awarded the contract for the construction of permanent barracks-buildings at the marine base at San Diego. The contract price is $949,500.

Contract for construction of a hydraulic-fill dam and a tunnel 6500 ft. long for the Happy Valley irrigation district in Shasta county, has been awarded to **W. A. Kraner** of San Francisco. The contract price is $315,000.

Guy E. Tripp, president of the board of directors of the Westinghouse Electric & Manufacturing Co., has received the distinguished service medal in recognition of his services when an officer in the Ordnance Department.

T. W. Ransom, chief inspector for the Emergency Fleet Corporation for the Los Angeles district, has resigned and will re-open his consulting engineering office in the Merchants Exchange Bdg., San Francisco, early in April.

Contract for grading and construction of retaining-walls for the new Alameda County hospital at 14th avenue and Vallecito place, Oakland, has been awarded to **J. P. Holland,** for $79,700. This is the first contract on this work to be awarded.

Charles Cory & Son, Inc., of New York, makers of marine mechanical and electrical devices, have opened an office and salesroom at 585 Mission street, San Francisco, and have also established an agency with the **W. S. De Pierris Co.,** Hoge Bdg., Seattle.

The **Southern Counties Gas Co.** has purchased from the **Southern California Edison Co.** its gas-plants supplying the cities of Santa Barbara and Ventura. The construction of a gas-pipe line from the Santa Maria field to Santa Barbara is also under consideration.

The Superior Manufacturing Co., of Lodi, is preparing to construct and equip a hollow-tile and concrete factory-building, to contain machine-shop, tool-room, and other departments. The estimated cost is $16,000. The company manufactures centrifugal pumps, check-valves, and similar equipment.

The inventor of the Bowes coupling, which is manufactured by the **Cleveland Pneumatic Tool Co.,** is the foreman of a small machine-shop at Pensacola, Florida. His royalty from the company is 2½c. per end or 5c. per coupling. Last year over two million were sold, which means over $100,000 in royalty for the inventor.

The **Sullivan Machinery Co.** has opened a branch sales-office and warehouse at Edificio Oliver No. 3, Mexico City. **Joseph F. Bennett,** for a number of years sales engineer in Mexico, associated with the El Paso office, has been placed in charge. His territory will include central and southern Mexico, south of the 26th parallel of latitude.

The Quigley Furnace Specialties Co., 26 Cortlandt street, New York, has issued bulletin No. 11, describing the equipment used in the Quigley system for preparing, distributing, and burning powdered coal. Furnaces fired by this system include those used for annealing, busheling, calcining, case-hardening, continuous heating, forging, galvanizing, melting malleable iron, puddling, open-hearth work, and many other purposes. The bulletin should be in the hands of all users of industrial fuel.

In the March issue of the 'Welding Engineer,' Chicago, there is a well illustrated article describing the plant of **Brown Brothers Welding Co.,** San Francisco. In a letter to the firm the editor states that he does not know of a better equipped commercial welding plant in the East and that there is certainly not in Chicago a plant that is as well fixed for both electric and acetylene welding.

The Kroyer Manufacturing Co. of Stockton has been organized to make the 'Wizard 4-pull' tractor. The company will soon commence construction of a plant on a 28-acre tract just east of Stockton. The first model to be manufactured will be a 12-20 hp. tractor for the orchardist and small farmer, but the intention is ultimately to have five different models, ranging in size from 6-10 to 45-75.

The International Molding Machine Co., 2614 Sixteenth street, Chicago, has issued a 110-page catalogue of its molding machines. The book is profusely illustrated with half-tones of the machines and of actual installations in operation in foundries. Descriptions and illustrations are given of several types of turn-over machines, jarring machines, squeezing machines, and stripping-plate machines.

Bristol's Indicating Electric Pyrometers are described in Bulletin No. 274 of the **Bristol Co.,** of Waterbury, Conn., with western offices in the Rialto Bdg., San Francisco. Pyrometers are a necessary part of the equipment in all industries where heat-treatment is used. Several types are illustrated in the bulletin. Special instruments are made for particular industries and applications. They can be furnished to indicate up to 3000°F.

The brake-shoe plant of the Enterprise Foundry has been purchased by the **American Brake-Shoe Foundry Co.** of California. This company is a subsidiary of the Delaware corporation of the same name, which practically controls the brake-shoe business of the United States. The Enterprise plant is to be enlarged so as to manufacture the brake-shoes required for the equipment of the new railroads that are projected in China, as well as for the Trans-Siberian system and other railroad enterprises in foreign countries bordering on the Pacific.

Plant of the Enterprise Foundry at South San Francisco Purchased by the American Brake Shoe Foundry Co.

The DFC method of burning oil is described in Bulletin No. 300 compiled by the **Denver Fire Clay Co.** This is primarily a low-pressure system. Any oil lighter than 18°B. may be burned, and is fed to the burner by gravity. The air that atomizes the oil and furnishes oxygen for combustion is supplied by a fan-blower of special construction operating at high speed. The air is delivered at a pressure of from 6 to 14 oz. and in the proper amount to effect complete combustion through atomization. On account of this low pressure, as compared with ordinary oil-burners, there is comparatively little abrasive wear on the furnace linings and relatively little noise. The control that can be obtained

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with this burner is one thing that distinguishes it. A low oil consumption and from one-fifth to one-tenth of the power required with other burners are other advantages. Various accessories are shown and some typical installations in furnaces manufactured by the Denver Fire Clay Co. are illustrated. **Braun-Knecht-Heimann Co.,** San Francisco, and **The Braun Corporation,** Los Angeles, are the California agents.

Bulletin No. 55 from the **Dings Magnetic Separator Co.,** Milwaukee, describes the 'Pulley-Type Magnetic-Separator with Bilge-Boards'. This separator is especially recommended when a large capacity in a single unit is desired. The advantages of this separator over the ordinary drum-type consists of its greater magnetic strength and in the fact that no brush or scraper is needed to remove the attracted iron. There are no important wearing parts except the conveyor-belt and the shaft-bearings. This company specializes in magnetic separators of several types and sizes for foundries, smelters, and refining plants. Ditty Bros., Balboa Bdg., San Francisco, are agents.

The Westinghouse Electric & Manufacturing Co. has issued a complete catalogue in which all its electrical supplies are listed. The catalogue comprises 1264 pages of descriptive matter pertaining to the products of the company, including a complete cross-index, index to style numbers, and a table of 'Approximate Cost Multipliers', which enables the reader to figure the approximate cost of all supplies listed. Although the book is called a catalogue, it contains a large amount of technical information. Practical suggestions for the use of many kinds of apparatus for the transmission and utilization of electric power are given. It is planned to issue this catalogue annually.

The Halcomb Steel Co., Syracuse, N. Y., has just issued the 5th revised edition of its 'Catalogue and Hints on Steel'. This little cloth-bound booklet, besides describing the various brands of tool and other alloy steels made by the company, gives practical directions for the hardening and tempering of the various alloys. A chart showing the heat-colors with the corresponding temperatures is given, and several pages are devoted to directions for tempering and annealing steel for different purposes. Tables in the back of the book give the weights of various sizes of bar steel per foot, decimal equivalents, and other useful information. The booklet may be obtained from the H. L. Van Winkle Co., agents, 160 Beale street, San Francisco.

The firm of **Woods, Huddart & Gunn,** 444 Market street, has been incorporated under the new name of **Gunn, Carle & Co.** The business will be conducted as heretofore but on a broader scale. The firm handles iron and steel products, electric furnaces, cranes, industrial trucks, and plant equipment and supplies.

Mr. Gunn was 18 years with the Union Iron Works of San Francisco and later was the promoter of the Columbia Steel Co. and the builder of its plants at Pittsburg, Cal., and Portland, Ore., leaving the latter company to enter his present business. The vice-president, Mr. Carle, has been associated with the firm for the past ten years as structural and sales engineer. A. G. Potts is in charge of the industrial department.

The main building of the **American Manganese Steel Co.,** on the Parr terminal tract on the Oakland west waterfront, is nearing completion. It is 80 by 260 ft., with side bays 60 ft. wide for the full length of the building. The bays are low so as to give ample space for metal sash for good lighting. The building is of concrete and steel. The roof is of corrugated asbestos, manufactured by the Asbestos Shingle Slate & Sheeting Co. of Ambler, Pa. The steel work is painted with Dixon's graphite paint. A three-ton Heroult electric furnace, core-ovens, annealing ovens for heat-treatment, Frost sand-mills, and other equipment will be installed in the main building. The plans also include a concrete pattern-storage building and another concrete building for lavatories and showers and with metal lockers for the men. The office building will be of frame-stucco construction. The main building will be equipped with one 5-ton traveling crane and one 10-ton traveling crane built by the Cyclops Iron Works. The oil-burning apparatus for the ovens will be installed by S. T. Johnson & Co. This plant is known as Plant F of the American Manganese Steel Co. Plants A, B, and C are at Chicago Heights, Ill., and Newcastle, Delaware.

The Commercial and Industrial Bureau of the Polish National Department has been established, with headquarters at 32 West 42d street, New York, George Fudakowski being in charge. This Bureau has the backing and indorsement of the new Polish government and of the Polish societies in the United States. To work in conjunction with the Bureau, the **Society of Polish Engineers and Businessmen** has been organized with headquarters at 33 West 39th street, New York. Ralph Modjeski is honorary president and Steven de Csesznak is president. The object of the new organization is to associate Poles in America for the purpose of co-operating and collaborating in the technical and commercial fields and to work toward closer economic relations between the United States and Poland. An idea of the present needs of Poland, and of the possibilities for supplying these needs and building up a profitable trade, can be gained from the official German reports of articles 'requisitioned' or stolen from Poland. The list includes 24,000 tons of iron, 18,000 tons of other metals, 4000 tons of chemical products, and many thousand tons of other commodities.

The Austin Co., of Cleveland, Ohio, has issued a 64-page catalogue explaining its method of erecting permanent and substantial factory buildings in the minimum number of working days, eliminating delays by standardization and quantity production. Illustrations and brief specifications are given for ten types of buildings, which can be built in from 30 to 90 days. For example, the No. 3 Standard which is a popular type and has been built for many prominent manufacturers, can be erected in 30 days. It is 100 ft. wide by any multiple of 20 ft. long. Buildings 660 ft. long have been built in 34 days. The building is of steel frame, 13 ft. under trusses, with cement floor, and walls of brick and metal sash. Over ten linear miles of this type have been built for Eastern firms including such well-known concerns as the General Electric Co., National Cash Register Co., Singer Manufacturing Co., Worthington Pump Co., and many others.

The National Smelting Corporation has recently received an order for a million pounds of manganese bronze which will be used in the manufacture of 264 propeller wheels for the Emergency Fleet Corporation. A great many different operations enter into the manufacture of this metal. The constituent parts of the composition are steel, ferro-manganese, copper, tin, zinc, and aluminum, and the peculiar characteristics of the bronze preclude the use of anything but the purest of metal, as more than a small proportion of lead will utterly ruin the mixture.

The American Bureau of Shipping and Lloyd's Register have rigid specifications covering the tensile strength, elongation, and elasticity of manganese bronze, and unless a blade has an ultimate tensile strength of 65,000 lb. per square inch, it cannot be used on a vessel. The constituent metals must be weighed, mixed, melted, and poured with great care and accuracy, as even a slight deviation from the chemical analysis would so reduce the strength that it would be useless for propellers. For instance, the addition of 2% more zinc than usual would reduce the strength of the bronze about one-third. Although only 2 oz. of aluminum go into the manufacture of each 100 lb. of the bronze, yet

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without this small quantity a great deal of the strength would be lost. On the other hand, if this quantity is exceeded considerably, an entirely different product results, again making the metal unfit for use in blades.

Great precision must be used in the successful manufacture of this bronze and those who really understand the finer points of its making, and manufacture it in quantities are able not only to get high quality but can put their product on the market considerably cheaper than the foundryman can make his own mixture. When manganese bronze is made from scrap metals it is necessary to have the composition analyzed and corrected by the addition of some of the constituent metals so as to bring it to the correct analysis before using it. Although the bronze can be made from scrap it is not usually of the required strength for the highest grade work.

Conventions and Societies

The American Steel Treaters' Society has been formed at Chicago to promote the arts and sciences connected with the heat treatment of steel. Branches of the society have been formed in Cleveland and in other cities. Sample copies of the society's monthly journal and other information may be obtained from the secretary, W. H. Eisenmann, 154 East Erie street, Chicago.

The San Francisco Association of Members of the American Society of Civil Engineers made an inspection trip March 8 to the concrete shipyard on Government island in the Oakland estuary. This is the first of a series of excursions for the coming season that is planned by the entertainment committee, which is composed of Fred R. Muhs, chairman; H. D. Dewell, and W. H. Popert.

The American Welding Society has been formed as a merger of the Welding Committee of the Emergency Fleet Corporation and the National Welding Council, and will include others who may be interested. H. C. Forbes is temporary secretary. Headquarters have been established at the Engineering Societies Bdg., 29 West 39th street, New York, where the first meeting was held March 28.

The Sixth National Foreign Trade Convention will be held at Chicago, April 24 to 26. The Foreign Trade Department of the San Francisco Chamber of Commerce has arranged for a special train leaving San Francisco April 20. Those attending the convention can arrange to return by way of St. Louis for the **Seventh Annual Meeting of the Chamber of Commerce of the United States,** which will be held April 28 to May 1.

Market Review

The most important event of the past month was the new price schedule on steel and iron products announced by the Industrial Board of the Department of Commerce. The iron and steel industry was the first to have a new schedule 'suggested' for it by the Board in its work of stabilizing prices at levels that will encourage buying. In general, pig-iron is reduced $4.25 per ton from the prices prevailing during the past quarter, and $6.25 from the prices of last year. Billets are $5 per ton cheaper than during the past quarter and $9 cheaper than last year. The corresponding reductions on bars and structural steel are $7 and $11 and on plates, $7 and $12. The new prices on the principal commodities, announced March 21, are as follows, quotations being f.o.b., Pittsburgh, unless otherwise noted:

Basic pig-iron	$25.75
No. 2 foundry pig-iron	26.75
4 by 4-in. billets	38.50
Small billets	42.00
Slabs	41.00
Sheet bars	42.00
Wire rods	52.00
Forging billets	51.00
Steel bars	2.35
Tank-plates	2.65
Iron bars, Chicago	2.70
Structural shapes	2.45
Blue annealed sheets	3.55
Black sheets	4.35
Galvanized sheets	5.70
Steel pipe, ¾ to 3-in., black	54% off list
Plain wire	3.00
Galvanized wire	3.70
Wire nails	3.25
Painted barbed wire	3.40
Galvanized barbed wire	4.35
Railroad spikes	3.65
Structural rivets	4.20 to 4.40
Boiler rivets	4.30 to 4.50
Cold-rolled shafting, carloads	28% off list

No change has been made in iron ore, and no change is contemplated unless freight-rates are reduced.

Freight-rates from Pittsburgh to Pacific Coast points are unchanged, namely $1.25 per 100 lb. on finished iron and steel products, including wrought-iron and steel pipe, minimum carload, 80,000 lb. On steel bars and structural steel the rate is $1.315, minimum carload 40,000 lb. and $1.25, minimum carload 50,000 lb. Add 3% war tax to all these rates.

The local market is unsettled and dull. During the early part of the month the approaching price revision discouraged buying, and the new prices had not, up to the time of going to press, been in effect long enough to have much influence on buyers. In general, purchases are made to cover immediate needs only, and unsettled labor conditions make those needs small. Representative local prices at the end of the month were as follows:

Foundry pig-iron	$47.00
Steel bars, mill base price, 30 days delivery, carloads	3.60
Steel bars, warehouse	4.00

Coke is $21 to $22 per ton.

Contract for furnishing 750 tons of steel for 12 new warehouses to be constructed for the California Associated Raisin Co. of Fresno, has been awarded to W. B. Kyle & Co., 74 New Montgomery street, San Francisco. The prices have not been made public.

The only local contract of importance was the steel framework for the new structural shop at the Mare Island Navy Yard. Prices named on 6120 tons of structural steel ranged from $130 to $134. On 85 tons crane-rails, the bids were around $95. On 53,300 lb. of steel stair-framing the figure was 8.5c., and on 70,000 lb. cast-iron tread and landings, 8.93c. to 11.1c. These bids have all been rejected and a new call will be issued.

The scrap market reflects the general conditions, with buyers restricting their purchases to a minimum. In particular, the mills are refraining from buying steel scrap in the hope of forcing a reduction in price.

Prices offered by local dealers for the non-ferrous metals are as follows:

Electrolytic copper, carloads	15.25
Lead	5.50 to 6.50
Zinc	8.00
Antimony	8.00

A slight improvement in both the demand and the price of copper is noted during the month. The other metals are practically unchanged. Similar to scrap iron and steel, the demand for old metals is small.

FOR SALE

One new steel water tank and tower, 75,000 gal. capacity; tower 90 ft. high above foundations; ladder inside tank; outside revolving ladder; cast iron final; overflow stub; separate ladder on column; tell-tale indicator; brass sleeved expansion joint; also anchor bolts and plates. Can be had for immediate delivery at an attractive price. Address UNION CONSTRUCTION COMPANY, Ft. 14th St., Oakland, Cal.

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